

COLUMBIA LIBRARIES OFFSITE
HEALTH SCIENCES STANDARD



HX00023779

THE SENSE OF PAIN & PLEASURE

RECAP

HENRY T. MOORE

QP435

Ou7

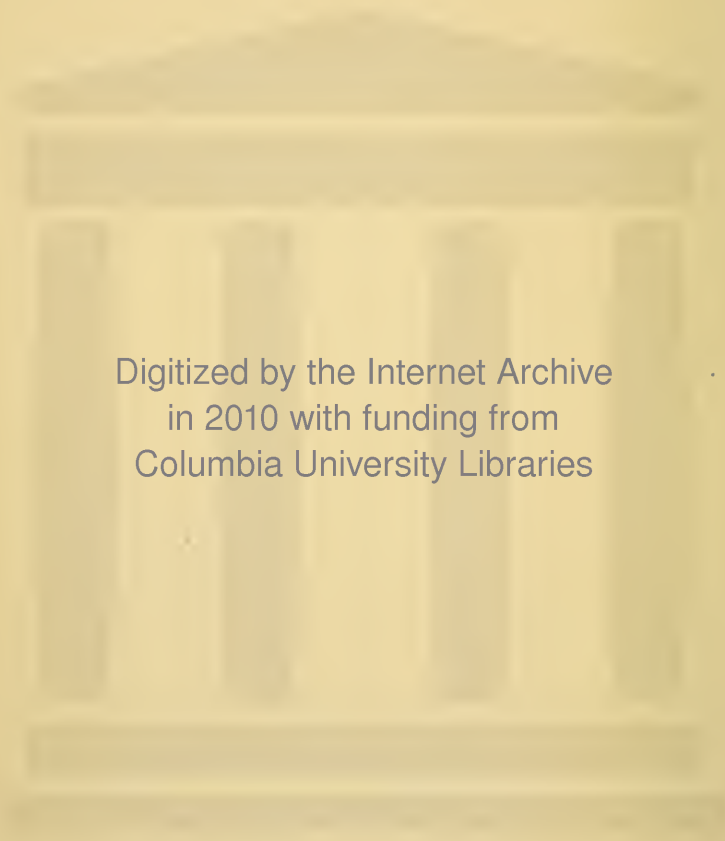
Columbia University
in the City of New York

3

College of Physicians and Surgeons



Reference Library



Digitized by the Internet Archive
in 2010 with funding from
Columbia University Libraries

PAIN AND PLEASURE

Our Senses Series—George Van N. Dearborn, Editor

PAIN AND PLEASURE

BY

HENRY THOMAS MOORE, PH.D.

Assistant Professor of Psychology, Dartmouth College



NEW YORK

MOFFAT, YARD AND COMPANY

1917

Copyright, 1917, by
MOFFAT, YARD AND COMPANY

Published August, 1917

Q P435

On 7

u. 3

TO
M. B. M.

15 " H.P.

PREFACE

In presenting to the public a volume on pain and pleasure as part of a series on the senses, a word of explanation is perhaps necessary as to the precise meaning attached to these terms. It may quite properly be asked how far I mean to identify these terms with sensation, and how far with feeling. Indeed, my whole position in regard to the relation of sensation and feeling naturally comes in question when unpleasantness is included as a variety of pain, and the sensation of tickling is put in the same general class with pleasantness. There is probably no more disputed ground in psychology than that which relates to the above point, and none in which more different shades of opinion have authoritative support. Speaking personally, I find it impossible to dispute the fact of a distinct difference between the sensation of pain and the feeling of unpleasantness, but the points of similarity seem far more significant than the points of difference. We may therefore without hesitation class them under a single general

PREFACE

heading even though recognizing them as subclasses of a primitive type of consciousness. The right understanding of this relation will, I believe, come as the result of a genetic study rather than of cross-section analysis. [The effort has been in the third chapter to suggest a probable line of genetic continuity from primitive pleasantness and unpleasantness to full-fledged sensory pleasure and pain.

Especial emphasis has been laid throughout on the broad, vital significance which all pain and pleasure experiences have in common. It is believed that a satisfactory philosophy of the problem of evil can proceed only from a psychology of pain and pleasure that lends itself to broad interpretation.

I wish here to acknowledge my especial indebtedness to Professor G. V. N. Dearborn for his kind loan of two hitherto unpublished hemobarograms showing the relation of pleasantness and unpleasantness to blood-pressure. These graphs appear in Chapter V.

Hanover, New Hampshire,

March 16, 1917.

EDITORIAL INTRODUCTION

Few people, comparatively, however intelligent and generally thoughtful, have as yet stopped to consider the surpassing interest and the unique importance of Our Senses. Living gateways as the sense organs are between ourselves and our ever-changing surroundings, both spiritual and material, they constitute the channels not only of our *life-satisfaction*, but of all our immediate *knowledge* as well. If, then, in discussing them, biological imagination and breadth and depth go hand in hand with technical knowledge of the highest grade, the volumes comprised should be both human and scientific. And these volumes are so, and will be. It is because of such possibilities that a series like the present, authentic yet interesting and inexpensive, must appeal to the intelligent man or woman of to-day. As contributions to psychology and to education their value is certain to be great, as indeed is indicated by the

viii EDITORIAL INTRODUCTION

list of their authors, whom it would be superfluous to praise or even to portray.

Small in number are the topics in all the wondrous range of the science of living things that are more alluring for their very mystery and romance than these same gateways by which we may go out into "our world" and by which this same great world may come into us and, for the little span of life, lend us a feeling of home-dwelling.

Within the past decade there has been a general popular awakening from the former uninterested attitude toward these phenomena of the physical and mental processes by which we keep in touch with the things outside ourselves. A fair knowledge of the rudiments of biology, of physiology, and of psychology now has become part of the curriculum of our schools and colleges. And of these three sciences it is psychology which has entered so deeply into our everyday life — business life as well as personal — that at last no one can escape its influence. And no one wishes to, for psychology in a sense has become the intellectual handmaiden of all who think in terms of to-day, with to-day's amazing development of insight

into the mortal meanings of our very selves, body always as well as soul. Our scientific realization of our true continuity with all things else goes on apace, and our personal relations to the boundless, perhaps Infinite, Cosmos of consciousness, life, and energy seem ever clearer. Thus, in a way, the sense organs give us personal anchorage in a Sea which else sometimes, from its very immensity and stress, would overwhelm us. Our range, although the broadest as yet vouchsafed to life, is as it were but a mere line out into the complexity of the Actual. The first step to the appreciation of this complexity and its implications for the human mind is knowledge of the conditions of its acquirement,—of the sense organs and of the perplexing brain behind them.

Editorial duty or privilege fails to know much as yet of the detailed contents of these several volumes. But the editor does know not a little about the arrangers and expounders of the volumes' contents, and he knows that they are women and men of conspicuous sense — trustworthy in every sense. The books are the best of their kind and are in a class by themselves. They are the standard authority for ordinary use. These vol-

umes when disposed as a red-backed set on one's library shelf will be a set of books to be proud of. And the high-school boys and girls and their fathers evenings and on Sundays and their mothers at the club all alike will think of them as highly valued friends, both wise and agreeable, as pleasant to meet for an hour as the most welcome visitor well could be. No higher "authority" exists than that which these authors represent; and it would be hard to find those who could set forth "authority" more gracefully. Each knows that literary *enjoyment* usually goes hand in hand with that *wisdom* which extended is the director of Life itself.

Of the many moot-points in the sister sciences of psychology and physiology, none probably is more mootable than the technical truth about pleasure and pain, pleasantness and unpleasantness. The psychologists (both amateur and professional, lawyers and salesmen as well as professors of psychology in the colleges) have inevitably a great interest in the subject of this volume, that double interest coming both from the very nature of a *mystery*, and from the circumstance that pleasure

and pain are *at the very heart* of every one, even of the narrowest and coldest intellectualist or algebraist. The psychologist then is both scientifically and humanly interested, and bound to be so always, in this theme, so that each new treatise on the subject will have a ready welcome.

On the other hand, who will suggest a subject in which the traditional unpsychologic "average" man (the term average never applies to a woman!) would be more interested, if he stopped just one moment to think of it, than in this two-phased subject of pleasure and pain? Does he not spend much of his time and money and precious nerve-strength exhausting his longing for pleasure? and surely more minutes every day than he would care to publish the number of, studying the avoidance of pain? And pleasantness keeps him living oftentimes; and unpleasantness continually reminds him that Earth not yet is heaven but full of worries and bothers, and sordid sometimes with petty disagreeableness,—even if too petty to properly burden a human soul. This book explains some of these feelings.

To every man interested in the undying problem of Job (the origin and need of evil in our

brief paradise) pain must have always a special interest. And to the moral philosophers, amateur and professional, both pleasure and pain.

Pleasure and pain in a way underlie the other topics set forth in the volumes of this Series, because every sensation is at least potentially either pleasant or the contrary. The editor personally leans to the opinion that the balance of evidence favors the view that pleasure and pain are two sensations and as distinct from others as are taste or hearing. From this way of "seeing" them (even seemly language is confusing sometimes), the larger number of common feeling-experiences are not properly painful or pleasurable at all, but rather are unpleasant or pleasant. But the terms pleasure and pain are used in common speech to include all four of these ideas. And after all, there *is* one broad, common-sense criterion beneath and at the same time above all such nice distinctions: A certain quality of sensation we all wish to continue or to return; and a certain other quality to cease and never to return. For the broker and the housewife, the soldier and the machinist and the farmer and their children and their sisters, this basal contrast after all is the

main means of judging this whole matter. But, none the less, it is not easy to doubt (until convinced of error?) that when the *microscope-men*, have taken up the problem of the general body-sense-organs with a subtlety of method at all adequate to the search, a relatively short time will give us the organic sense organs of pleasure and of pain, and probably the respective nerves thereof. With this identification to use, in turn it will not be long, perhaps, before the technical uncertainty is solved as to whether or not they really are sensations!

What our present author has done in this volume the editor thinks he has accomplished with remarkably good judgment; and with a technical descriptive skill which the literary critic, as well as the psychologist, must admire. It surely is one more demonstration that a book may be of a high scientific standard and yet of ready and permanent interest to the educated million for whom, after all, science ultimately exists. Sometimes the "seeker" who can write only for his colleagues possessing the same edition of a dictionary, forgets this, the "final purpose" of science.

The volume is free from theorizing to an un-

usual degree; it simply states and states simply much of what its author knows about his subject. And really, a psychologist who refrains from theoretic discussion in this particular realm of feeling is a being of strong personal restraint. For a relatively brief book, the volume says much and that scientifically and popularly well.

Professor Moore has emphasized anew the important thesis that in a sense and a degree, human struggle is the index of pleasure and of pain, using the terms in their broader meanings. This viewpoint not only lets us understand the reason for their bodily evolution as the chief motives of behavior, but it places them in the long scale of moral, that is, permanent, values.

Scarcely any topic in psychology is more humanly interesting in its history than the published opinion concerning pleasure and pain and the other experiences of which these words are symbols, but our author, with a full realization of this human interest, by the plan of this Series has been compelled to omit this the historical phase of his subject.

But just now it is enough that it is a comprehensive account clearly and yet scientifically ex-

pressed of a topic of surpassing interest to every conscious being — the latest word on pleasure and pain, and a word that is full of meaning and feeling for us all.

G. V. N. D.

Cambridge, Massachusetts,
April, 1917.

CONTENTS

CHAPTER		PAGE
I	VARIETIES OF PAIN	I
II	VARIETIES OF PLEASURE	16
III	PROBABLE ORIGIN AND DEVELOP- MENT OF PAIN AND PLEASURE . .	33
IV	THE MEANING OF PAIN AND PLEAS- URE	53
V	THE BODILY EFFECTS OF PAIN AND PLEASURE	76
VI	THE NERVOUS BASIS OF PAIN AND PLEASURE	96
VII	THE DIAGNOSTIC VALUE OF PAIN .	117
VIII	ÆSTHETIC PLEASURE	134
IX	PLEASURE IN PLAY	146
X	THE PARADOX OF PLEASURE SEEK- ING	152
XI	CONCLUSION	164
	BIBLIOGRAPHY	167

ILLUSTRATIONS

	PAGE
Fig. 1. Amoeba chasing and attempting to ingest an euglena . . .	36
Fig. 2. Positive reaction of paramecium to pleasant contact . . .	37
Fig. 3. Reactions of paramoecia to heat and cold	39
Fig. 4. Laughing chimpanzee (<i>half tone</i> <i>facing</i>)	48
Fig. 5,A. Hemobarogram	89
Fig. 5,B. Hemobarogram	90
Figs. 6, 7. The nervous system	98
Fig. 8. The ascending and descending tracts between cord and cortex	100
Fig. 9. The middle and lower brain . . .	102
Fig. 10. Cross section of skin	110
Fig. 11. Nerve endings	112

PAIN AND PLEASURE

CHAPTER I

VARIETIES OF PAIN

WHEN a speaker uses the word "pain" or "pleasure," it is probable that his hearers feel that they have a fairly adequate notion of what he means. And yet it needs but little reflection to convince one's self that these words, as commonly used, include a much wider variety of mental experience than do any of the other words that describe particular sensations. The sense of hearing at once suggests to me something that is either tone or noise; the sense of vision something that either has color or is lacking in color. But "pain" is not so easy to limit strictly to a special group of facts. It may refer to something so trivial as pricking a finger, or it may mean something of such far-reaching importance as grief at the death of a beloved friend. The fact that these two

widely different experiences may both be appropriately described as painful, suggests to us that somehow pain is more deeply imbedded in the fundamental conditions of our existence than are hearing, vision, taste, or smell. For this reason, a satisfactory understanding of the "sense of pain" can come only from an adequate array of concrete instances of painfulness,—both those instances where pain seems to be a simple sensation, and those in which it involves our emotions and higher thought processes.

Surface Pain

There is, to begin with, a very large and familiar list of pains which result from injury at or near the surface of the body. Whether we step barefooted on a tack, or pick up the wrong end of a hot poker, or tear a finger-nail at the quick, or offer a sensitive tooth to the tender mercies of an aggressive dentist, we are certain to be rewarded in any of these cases by a very definite kind of sensation quality. It appears to us as something very bright and sharp-edged; it is so insistent that it forces us to pay attention, and so disagreeable that our natural impulse is to make

very definite and energetic movements of withdrawal.

Taken as a class, these pains are distinguished from all others by their extreme pointedness and by their definiteness in consciousness. They give us exact information to the effect that, as far as we are personally concerned, something is radically wrong in the world outside,—something which we can hardly afford to leave out of account. As if to safeguard their function of imminent warning, they ordinarily refuse to disappear completely from consciousness until the source of disturbance has been removed. In this respect they differ notably from all other forms of sense experience. For example, few sensations of smell can last continuously for more than two minutes; even the strong odor of asafetida is exhausted in one and a half minutes, and the strongest cheese smells are likely to become odorless after eight minutes. The sense of touch is so easy to get accustomed to that the absent-minded person not infrequently finds himself looking all over the house for the spectacles on his nose or even for the hat on his head.

But the acute sense of pain described above is

not easily cheated out of its hold on our attention. The dentist's buzzer is more and more carefully scrutinized after each new insertion into the open tooth, and the throbbing of the injured finger becomes more and more unendurable until healing actually begins to set in.

Bodily Distress

Quite different in many respects from the pains announcing harmful contact with the outer world are those which serve to indicate that the inner working of the body is not proceeding successfully. To appreciate this difference one has only to contrast a splitting headache with a pricked finger, a cramp in the stomach with a scalded foot, or a twinge from about the region of the heart with the smarting from a razor cut on the face.

One especially curious fact about this second class of pains is that they originate in organs which can scarcely be made to give pain as the result of injury inflicted by ordinary external means. It is always necessary that the organ be thwarted in its normal function by some condition developed from within the body, such as inflammation, disease, new growths, etc. Surgeons

have repeatedly assured themselves that no amount of mechanical insult to the stomach or intestine, after the peritoneum has been opened, will provoke any outcry from the patient. From the day when Xenophon in the "Anabasis" wrote of Nakarchos, the Arcadian, "wounded in the abdomen in battle, and coming in flight, holding his entrails in his hands," evidence has continued to accumulate to the effect that the intestine can be cut, pinched, rubbed with gauze, seized with a clamp, or pricked with a needle,—all without the faintest indication of pain. The writer has recently learned from an ambulance driver in the French hospital service in the present European war of a case in which a French sergeant, shot through the chest to the right of the heart, and exit near the spine, said that he felt merely a sort of burning, and this in spite of the fact that he spat blood for several days, and had many clots removed. And yet nothing is more certain than that an ulcer in the stomach produces spontaneous pain as well as extreme tenderness to pressure. And the lump-like pains that go with a colicky digestion are the despair of the sufferer as well as a joy to the agent for dyspepsia tablets.

The facts just cited in regard to the stomach and intestine are paralleled in other inner organs. [The brain surface has of late been freely explored with surgical instruments and with weak electrical stimuli, always without pain being reported by the subject under operation. Nevertheless the brain seems to be extremely sensitive to its own changes in volume, or to any abnormal internal conditions, such as cerebral abscesses, which make for an increase in intracranial pressure. An equally good illustration is to be found in the case of the blood vessels. They seem to be immune from pain produced by any ordinary external means, but when their normal function of distributing the blood is seriously thwarted, they give rise to excruciating pain. One experimenter, working with dogs, found that a binding of the vessels caused extreme discomfort; and it is without question that the suffocating contractions in *angina pectoris* are to be reckoned among the severest pains.

From the foregoing, it is clearly evident that the ordinary method of arousing inner pains is radically different from that of stimulating surface pains. The more outward lying parts of the body, such as the skin, muscles, tendons and joints,

which afford us a means of intelligent understanding of the outer environment, are necessarily more sensitive to that environment.

In respect to quality of sensation the inner pains are again strikingly different from the outer. Without exception, they are heavier, duller, and give us a less exact clue as to the location of the trouble. When one tries to describe them, he at once finds himself very indefinite both in his choice of adjectives and in selecting the exact spot from which the pain seems to originate. Such expressions as "a feeling that something is wrong inside" or "a feeling as if something were about to give way" form a considerable part of our vocabulary describing abdominal disorders. A number of ignorant soldiers, when asked to point to the part of the body most concerned with the pangs of hunger, gave the most conflicting responses. Several pointed to the neck and upper chest; only two indicated the stomach, and four were unwilling to admit that it came from any particular region. Indeed, so lacking in definiteness is this class of pains, that they as often as not give a false account of themselves by affecting other nervous connections. Thus some abdominal

diseases cause a shoulder pain, and angina pectoris may very definitely affect the arm or neck. In short, the well defined areas of the outer surface of the body, when indirectly aroused by pain from within the body, succeed in impressing their own local character at the expense of the vaguer inner disturbance by which they are aroused.

The same lack of definiteness is seen in the way we react to inner discomfort. Whereas the injured hand is promptly and effectively removed from the occasion of injury, the aching stomach succeeds in producing for the most part only helpless writhing and groaning. To be sure we do learn a few simple devices for keeping the pain as endurable as possible. We may find that lying on the stomach gives a position of maximum relief, or in the case of headache, we may discover that bending the head backward or bathing it in cold water is efficacious, but for the most part our behavior resembles that of an organism very poorly equipped in resources for self-protection. We seem to descend a long step in the scale of intelligence every time we make the transition from the exactly coördinated impulses by which the skin defends itself, to the blind protests of diseased

inner organs. For this reason we are justified in using the term "distress" to characterize this class of pains as distinct from the exact pains of the first class, which we may hereafter refer to as "pain."

Unpleasantness

A person of robust health may go practically from one day's end to another without any thought of what is taking place within his body; and modern conveniences and safety first philosophy are gradually eliminating the occasion for scratches, cuts, and burns, so that it might be possible to look forward in time to an era of painless life, if it were not for the existence of a third type of painful situation, which comprises decidedly the major fraction of the ills to which flesh is heir,— the unpleasant.

By contrast with surface pain, unpleasantness is even more than bodily distress lacking in any clear and direct outline which makes it possible to set it apart and think of it separately from the total situation in which it occurs. It is this marked lack of clearness which has convinced the greater number of psychologists that unpleasantness and pleas-

antness are unique mental experiences to be considered apart from any other kind of mental content. "Unpleasantness is a feeling," they say, "pain a sensation." [There is weighty authority both for and against this statement, and the controversy can hardly be said to be completely closed. It matters not for our present purpose whether the statement be confirmed or denied. What all are agreed on is that the resemblances of pain and unpleasantness are as significant as their differences, and that the ultimate explanation of one is probably also the explanation of the other; hence the inadequacy of any account of one that omits parallel reference to the other.

Owing to the very fact of its indistinctness, unpleasantness seems to take on the special character of everything with which it is associated. The taste of quinine is like the discomfort at having made a social blunder, in that both are unpleasant, but the unpleasantness has so lost its identity that it is hard to disentangle it from the taste sensation in the one case and from the complicated social emotions in the other. The result is that the number of unpleasantnesses is as great as the number of possible variations in our mental life. We

probably come nearest to recognizing unpleasantness as such, when something pleasant is allowed to become unpleasant by being continued too long or by being made too intense. If the pleasing warmth of a bath is gradually transformed to an excessive heat, it is almost possible to catch the unpleasantness coming in and taking the place of the pleasantness. To be sure it is like trying to turn up the gas quickly enough to see how the darkness looks, but one at least gets the hint of something almost at hand, even though he can't quite imprison it and look it in the face. Again, when any commonplace pleasure, too long drawn out, gradually produces boredom, one is fairly conscious that his ennui has supervened on a situation otherwise unchanged, and he at least infers the separateness of his unpleasant feeling. We are also fairly able to form an indirect notion of what the disagreeable qualities of simple sensations are in themselves. When one smells a foul odor, or touches something clammy, or listens to a high grating noise, he experiences unpleasantness in a fairly accessible form. A little harder to disentangle is the same effect when we look at a combination of colors that "swear at each

other," or hear an orchestra playing badly out of tune. But the unpleasantness of being unable to collect one's thoughts, or discovering that a trusted friend has proved disloyal, is almost inextricably woven in with the complex situation of which it is a part.

Long education in the great variety of unpleasant mental states has endowed man with a countless number of different gestures and facial expressions indicating dislike and avoidance, but these specially learned reactions ought not to blind us to the essential fact that unpleasantness as such is an obscure and unintelligent state of mind. While it lasts, it only serves to lessen activity and to turn us in on ourselves. A primitive organism submitted for a time to disagreeable treatment, tends more and more to shrink within itself; if badly frightened, it may even curl up and "feign death." A human being, if his consciousness is sufficiently taken up with the same kind of feeling, behaves in a very similar manner. Sickening dread and paralyzing fear are synonymous with an almost complete cessation of effective bodily response. Shame, sorrow, and all the rest of the emotions of marked unpleasant tone, present some-

what the same picture of a person given over temporarily to the organic and vegetative side of his life, and distinguished for a cessation of anything like intelligent behavior. This is best seen in the case of those types of insanity in which melancholic and dreadful thoughts predominate. These unfortunate persons seem deprived of every resource except that of huddling up in as small a heap as possible. If a violently disagreeable sensation is one for which a person has not already formed effective habits, the result is likely to be a complete giving up of the ghost, and an otherwise intelligent person may become reduced to a mere quivering lump of unhappiness. It is reported that recently on one of the trans-Atlantic passenger liners, when a submarine was spied approaching for a torpedo attack, some of the seasick passengers refused to have any interest in the threatened danger, and would not take the most elementary measures of precaution. It is not by accident that pessimism is associated with inefficiency. A life given over permanently to unpleasantness is a life doomed to a shut-in existence and lowered vitality. [The current saying that the world does not need knockers but boosters, is a

popular expression of the fundamental fact that unpleasantness, even more than bodily distress, is a state of mental emptiness.

What has just been said does not stand in contradiction to the well-known fact that the after-effects of unpleasant experiences are of far-reaching consequence in modifying our behavior. If the burnt child did not dread the fire, and the young chick which had pecked a bad-tasting caterpillar did not avoid a repetition of the occurrence, there would be no possibility of progress toward the selection of the agreeable. But the learning that comes as an intelligent working-over of unpleasant experiences does not gainsay the blindness of the unpleasant reaction itself.

Summary

Our review of painfulness has brought to attention three fairly distinct types. The first type, surface pain, is distinguished by sharp clearness, exactness of location, and well-coördinated reaction. The second type, bodily distress, is characterized by obscure dullness, difficulty of exact location, and a quite general and somewhat aimless bodily reaction. The third type, unpleasant-

ness, is marked by such obscurity that it is commonly spoken of as feeling; it has no particular location, but seems to pervade the whole body; and its corresponding bodily reaction, with the exception of a few special habits learned or instinctively provided, is one marked by an indefinite shrinking, involving pretty much the whole body.

CHAPTER II

VARIETIES OF PLEASURE

Surface Pleasure, or Tickling

EVERY healthy child likes to be tickled. A friendly attack with a straw or feather on the soles of the feet, or a brisk use of the fingers up and down the ribs or under the armpits ordinarily provokes screams of laughter in any youngster. When in the midst of his paroxysms he may cry out to his assailant to stop tickling, but when he has been released, he will usually beg to have the fun begin again. The immediate pleasurable-ness of this kind of diversion may be judged by the fact that any pronounced tickle zone is often referred to by young children as the "funny place." In general it can be said that this pleasure sensation, which differs so strikingly from the surface pain described in the first chapter, is provoked by stimuli too weak to do any real harm, but just strong enough to faintly suggest injury without

actually bringing it about. Whereas pain results when the skin is injured or pricked, pleasure results when it is faintly threatened but left intact. As soon as the contact with the skin becomes so broad or solid as to be recognized with certainty, one no longer feels any tickling or tendency to laugh, for the threat no longer exists. One has instead the definite and familiar feeling of a harmless object. For this reason we cannot easily tickle ourselves with our own hands; their touch is too well-known to us; we may succeed with a feather or with something only weakly recognizable, but the same feather is far more effective if manipulated by the hand of another person.

It is for this reason also that the change to a mood of sullenness in a person being tickled will suddenly render him immune from the effects of what, a moment ago, convulsed him with laughter. Just as an angry person refuses to let himself be terrified by danger threatened by one who has offended him, so he fails to feel any ticklishness in the playful threatening of his skin by one whom he dislikes. The skin of a person made unafraid through hostile emotion seems to acquire a certain invulnerability which takes account only

of pressure contacts. It is little concerned with either actual or possible injuries.

Once again, the pleasure sensation which, if made too familiar, so readily goes over into indifferent pressure, may just as easily be changed into a kind of painfulness if made completely unfamiliar, or if brought about under conditions where self-defense is made impossible. Thus if a ticklish youngster is taken completely unawares by a string slyly drawn across the back of his neck, or if his dangling bare foot unexpectedly finds its way into contact with the gently quivering point of a wisp of straw, his withdrawal is made with almost the same promptness as if he had been pricked with a pin. And the light crawling of a beetle which has found its way underneath his shirt, may provoke the laughter of bystanders, but their amusement is far from meeting with a sympathetic response in him, unhappily occupied as he is. We see then that a very slight change of conditions one way or the other may convert the "funny feeling" of tickling into mere touch or into unpleasantness. Indeed there are some parts of the body where the best that tickling can do is to cause pressure; others where it can't be made

other than disagreeable. For most people the extreme tips of the fingers are free from ticklishness. They are so educated in the interpretation of contacts that it is impossible to mystify them. The minutest variation in the form of anything touched has a very definite meaning for them; hence it is impossible to create for them a situation full of vague possibilities. For most people, again, the inside of the ear and of the nostrils gives only disagreeableness in response to tickling. It is almost as it were against the rules of the game to attack via the nose and ear. At any rate the threat to injure inner passages of the body hardly admits of playful interpretation. Generally speaking, however, the most vulnerable parts of the body are the most ticklish. Hall and Allin, on the basis of a considerable amount of data, have concluded that the order of ticklishness for the various parts of the body is as follows: soles of the feet, under the arms, neck and throat, ribs, back, under the chin, stomach, knees, etc. The least ticklish parts were the shoulder-blades, shoulders, calves and thighs of the leg. It appears at once that the first list contains those parts which exhibit the greatest vulnerability and

suggestiveness of danger, whereas the parts named in the second list are marked by a certain ox-like invulnerability and obtuseness.

The ticklishness of individuals shows the same relation to sensitiveness and presumably to vulnerability. This sensitiveness may be raised to such a pitch in high strung children that an explosion of laughter will result from the slightest provocation. Hall and Allin mention cases of children so ticklish that they scream with laughter if merely touched; one child writhes and screams if a friend makes a buzzing sound; another feels ticklish and must giggle in going down an elevator; and still a third needs only to be pointed at to feel tickled.

As often as not, tickle is referred to as a weak sensation of pressure. The "funny feeling" itself, however, almost beggars description. [The most characteristic feature, perhaps, is the feeling of strain giving way to a burst of excess energy. If the strain is sufficiently great and the explosion correspondingly tremendous, we speak of it as being "killingly" funny. Although much more difficult to place than surface pain, the funniness does seem to begin either in the part tickled, or in some general region such as the stomach, throat

or face, and then to diffuse itself rapidly over the entire body.

It was noted in the preceding chapter that the bodily reaction to surface pain was a very exact and calculable affair. Sticking one thousand boys with a pin would lead to the discovery of very few variations in the boyish mode of response to pin-sticking. With tickling the case is wholly otherwise. From the youthful stoic whom nothing can induce to smile, to the little hysteric who howls in an agony of glee at the mere crooking of a finger, the number of individual variations is legion. More often than not, the first indications are given by a brightness or twinkling of the eye; but in many cases a sudden dimpling of the cheeks or slight twitching of the corners of the mouth may be the first visible sign that the tickling has been accepted as funny. Even before the snorts of laughter have set in, some form of defensive movement has usually been brought about. Those movements are described by Sully as follows: "retraction of the foot and leg when the sole is tickled; the bending of the head to the shoulder when the neck is tickled; the rendering of the body concave on the side which is attacked;

the thrusting away of the hand of the tickler; wriggling and fencing with the arms when a child is tickled lying on his back." While these movements are never exactly reproduced in any two individuals, it is in the final expression of laughter that the greatest variation is to be found. One finds facial distortion in infinite variety, vocal outbursts that run all the way from soft gurgling to cackling peals, and individual rhythms varying from a quite gradual to an instantaneous onset. Evidently the tickling reaction has not yet become a stereotyped part of the behavior of the race. By contrast with pain, it seems decidedly an unfixed and individual feature of human behavior equipment.

Gratification, or Pleasure of the Inner Organs

No one organ in our bodies carries with it as much possibility of pleasure as of pain, but there is unmistakable evidence that every organ, when adequately functioning, contributes its share to the total background of pleasure, which inspires the healthy man to remark, "It seems good to be alive."

It is naturally to be expected that organic satis-

faction will be the keener in proportion as the organ's function is of supreme importance for the life of the individual and of the race. When the painful contractions of an empty stomach are replaced by the mild tension resulting from a comfortably large meal, this restoration of an indispensable condition of life is heralded by one of the most all-pervading pleasures that the vegetative side of our life knows,—the pleasure of satiety. It is almost as though the man's soul had temporarily taken up its abode in his belly, and were announcing from there its satisfaction at the way things were proceeding. Civilized man, with an abundance of food, has in a measure developed a fine scorn for one who eats with conviction; but among savages and young children, with whom the food question is perpetually at hand, one often finds that the recognized sign of pleasure is some expression which indicates the taking-in of food. Travelers have reported that the negroes on the Upper Nile display their admiration for beads by rubbing their bellies, and that Greenlanders, when they wish to show their pleasure, suck down air as if swallowing food.

As one could live even less without water than

without food, the grateful effect of quenching thirst is correspondingly more acute, and the occasions are likewise much more infrequent when the need is urgently felt. The satisfaction seems to be most definitely localized about the soft palate; indeed one may for a time cheat himself by merely moistening his parched throat, but the complete act of swallowing is necessary to get the full course of satisfaction which normally trails after the liquid. One would have to imagine himself traveling by caravan or in company with the Ancient Mariner to picture even faintly the hilarious ecstasy which probably accompanies the slaking of real thirst. The pathological craving of the dipsomaniac, although a morbid state, offers the most frequently observed illustration of the intensity to which the thirst impulse and the corresponding pleasure of its satisfaction may conceivably attain. Professor James cites the following case from Cincinnati, Ohio: "A few years ago a tippler was put into an almshouse in this state. Within a few days he had devised various expedients to procure rum, but failed. At length, however, he hit upon one which was successful. He went into the wood-yard of the establishment,

placed one hand upon the block, and with an axe in the other, struck it off with a single blow. With the stump raised and streaming, he ran into the house and cried, 'Get some rum! My hand is off!' In the confusion and bustle of the occasion, a bowl of rum was brought, into which he plunged the bleeding member of his body, then, raising the bowl to his mouth, drank freely and exultingly exclaimed, 'Now I am satisfied!''

The following statement from a French soldier¹ in the present war parallels in normal life the above pathological case. It is quoted from an account of trench life given by a wounded private: "In the north, it is often hard to get water. I have seen soldiers go without water for 48 hours. Some were wounded, and very thirsty. They tried to drink the filthy water in the trenches. An officer stood over them. 'If you drink that water I'll shoot you dead!' 'Shoot me if you like, officer,' said the soldier, 'but I must drink.' And he did.

The pleasure derived from the free circulation of the blood and from breathing without difficulty

¹ From unpublished notes of O. H. Moore on "Relief Work in France."

is something to which we get so adapted that it requires some special circumstance to bring it to our attention. To be sure there is a certain irreducible minimum of exhilaration that the man of brisk circulation and sound lungs carries about with him constantly, but for the most the frequently recurring functions rarely intrude themselves in consciousness. It is only after the oppression of submitting to the stuffiness of a badly ventilated room that we keenly appreciate the pleasure of a deep draught of fresh air; or when catching our "second wind" after a suffocation that we consciously realize the joy of breathing as far down as the waist-line. In these cases the air is like wine, and the pleasure of a breath as poignant as that of drinking when thirsty. It should be noted, however, that in the case of the extremely vital functions, any really considerable thwarting necessarily brings us so near to utter collapse that much time is necessary to restore anything like normal functioning; and hence the gratification, which would ordinarily mark our return to equilibrium, is entirely obscured by the after-effects of shock. For example the choking gasps of a person who has

almost been drowned fail to offset the widespread discomfort that has been stirred up within.

The pleasures so far considered have centered about the organic functions of especial importance in maintaining the life of an individual. There remains one function, the appropriate performance of which has little importance in furthering the individual's life, but which is as indispensable for the race as breathing is for the individual. It is provided accordingly that reproduction should be attended by a pleasurable corresponding to its vast importance to the race. Continuous existence of the race can be assured only by a superabundance of lustfulness in the individual. Unique in its importance, sexual gratification is also unique in its conscious quality. Though less intense than the pleasure derived from satisfying acute hunger or thirst, it is, however, much more general in its bodily reverberations. No dramas have ever been written about hunger or thirst. Occasionally the bibulousness of a Falstaff or the sweet tooth of a "Chocolate Soldier" add to the gayety of the nations; but such literary effect is usually limited to the comic, and offers not a fraction of the intricacy to which the sex motive so

readily lends itself. The latter is so inexhaustibly fertile in new and interesting possibilities that it will probably continue to inspire the "best sellers" as long as the novel is a popular form of pastime. Hence it is not possible to limit sexual gratification strictly to a single local reference; it has a widespreadness of bodily content which no other pleasure can begin to equal. All that the poets have written of love bears out the fact that every sensitive part of the body plays a potent part in this connection. For lovers, the merest touch of the hand, the meeting of the lips, or the clasping embrace,—all are forms of caress which offer intense physical satisfaction. There is certainly no little plausibility in Freud's conjecture that the whole body was originally a more or less undifferentiated seat of sexual desire, and that only by degrees of development have we reached the stage of highly specialized reference.

Pleasantness

A life limited to tickling and bodily gratification would be indeed poor in pleasure. There are few people who would not prefer the lot of Socrates dissatisfied to that of the pig content, even if the

choice were made on purely epicurean grounds; for one of the outstanding facts about pleasure is that innumerable varieties of pleasantness, taken together, completely outweigh the grosser and individually more intense gratifications.

What has already been said of unpleasantness holds good with appropriate modifications for pleasantness. It is so lacking in definiteness that it seems to take on the character of whatever it happens to be associated with. One must have a certain introspective skill in order to separate the pleasantness from the sweet taste, from the sight of the blue horizon, or from the smell of the rose. We meet with most success if we take, to begin with, something disagreeable and weaken it gradually until it first becomes indifferent, then mildly pleasant. For example, the taste of grapefruit, by contrast with stronger bitter tastes, is for most people quite agreeable; a very faint whiff of rank smell adds to the palatal appeal of certain cheeses; musk and civet are sickening until diffusion renders them pleasant; and distance lends enchantment to even the harsh tones of the trumpet. In all of these cases, a sensation disagreeable at normal intensity becomes pleasing as

it grows weaker; and we have a much better opportunity to catch pleasantness at work than when we apply ourselves to tastes, smells, and sounds of a sort that could hardly be unpleasant under any circumstances.

But such occasions are decidedly the exception. Every possible variation in our mental life seems to bring with it a kind of pleasure peculiar to it. Whether one converses with friends, listens to a concert, or realizes his ambitions, the pleasantness in each case is so intimately a part of the particular situation that it is impossible to disentangle it and to regard it as something *sui generis*. Like the clay which readily assumes any desired form in the hands of a modeler, pleasantness is all things to all states of mind; it is so much undifferentiated stuff, having in its own right only the fundamental characteristic of being agreeable and associating itself in such a variety of contexts that we speak equally often of a pleasant sight, a pleasant thought, or a pleasant mood.

The numerous bodily attitudes expressive of pleasantness are to be understood as the result of special adaptations of an original vague tendency to expand and approach. In an organism not

developed in intelligence we may imagine that pleasantness would express itself simply as a general unfolding and drawing alongside the pleasing object. In ourselves, the beaming smile, the open hands, and the readiness to come forward are the special developments of this general bodily receptivity. But though this forward-coming attitude of taking in as much as possible of the agreeable, makes it easier for us to know most about what we like best, it remains true that the pleasantness itself, like unpleasantness, is vague and obscure. When given over to it with complete abandon, our speech becomes reduced to mere ejaculation and our thought correspondingly limited. It is partly for this reason that one who thoroughly enjoys art or music is in a measure handicapped in his criticism by his very capacity for enjoyment. The story is told of a celebrated German pianist, that persistent effort to obtain his views on Beethoven and Wagner elicited only two brief expressions: "Beethoven ist gut; Wagner ist nicht gut."

Summary

[To summarize briefly what has been said regarding the three chief types of pleasure:

Tickling, produced by stimulating the surface of the body, calls forth a fairly definite pleasure sensation and a laughter reaction. It varies extremely from individual to individual.

Gratification, or the pleasure derived from satisfying the needs of inner organs, is distinctly experienced for each of the vital needs. The pleasure in each case seems to reside most particularly in the general region of the organ concerned, but it is by no means possible to give it an exact location.

Pleasantness is least of all capable of exact location or definition. The characteristic reaction is an attitude of the whole body which, in some fashion, goes out to meet the agreeable object and to further relations with it. It never appears separately, but always as the accompaniment of some other state, such as sensation, emotion, memory, or thought.

CHAPTER III

PROBABLE ORIGIN AND DEVELOPMENT OF PAIN AND PLEASURE

Do animals feel pain and pleasure? For the man on the street who beats his horse in order to drive him faster, it is almost axiomatic that the horse feels pain. The organization of a "Society for the Prevention of Cruelty to Animals," and the widespread sentiment against vivisection could hardly have come about without an intuitive disposition to answer this question in the affirmative. And as for pleasure, there is hardly a dog fancier in the world who does not interpret the dog's wagging of his tail as in some sense the equivalent of the human smile, and there is certainly no one on speaking terms with cats who does not understand a particularly sonorous purring to mean that kitty is in a decidedly optimistic frame of mind. But when one attempts to draw the line and decide the extent to which pain is felt

throughout the animal kingdom, the question at once becomes peculiarly difficult. If we take as examples animals that are very low in the evolutionary scale, it seems most questionable to attribute cruelty to acts which, if applied to ourselves, would be deemed brutal. [The fisherman, for all the sharpness of his hook, would resent any attention from the "Society for the Prevention of Cruelty to Animals." Animal psychologists have often noted how philosophically the earth worm submits to having his body cut in two. Instead of giving outward indication that he objects seriously to such gross bodily mutilation, he proceeds along in his usual leisurely manner, scorning the things of the flesh. Examples of a similar kind might be multiplied indefinitely.

All speculation as to the state of mind of any animal is based on indirect evidence. Such evidence as is available suggests very strongly that there have been three fairly distinct stages in the evolutionary history of pleasure-pain in animals. The first stage — that of the lowest organisms — was probably one in which there was only a crude experience of well-being, or of malaise,— the raw stuff of pleasantness and unpleasantness.

The pain-pleasure reactions of the animal in this stage would be limited to total bodily movements of retreat or approach. The second stage, that of animals a little higher up, would include, in addition to the primitive pleasantness-unpleasantness, the more specialized experiences of gratification and distress. The highest stage, that of animals relatively near the top of the scale, would include, in addition to the preceding states, the very special sensations of pain and of tickling.

As an example of the first stage we may examine the behavior of an amœba. This simplest of all animals is lacking in anything which remotely resembles a nervous system. Its whole body, in fact, consists of a single cell, and its behavior is limited to three reactions. The negative reaction is brought about whenever the amœba collides with a solid obstacle, or moves into an overheated region or when a ray of light falls on one side or an electric current is passed through the water. What the amœba does in such cases is to check any movement in the direction of the unfavorable stimulus, and to withdraw or change direction by contracting pretty much its whole body. It is the same sort of thing that we do when we find our-

selves in an unpleasant situation; and if we venture to credit the amœba with a state of mind, its attitude is probably a vague "I don't like it."

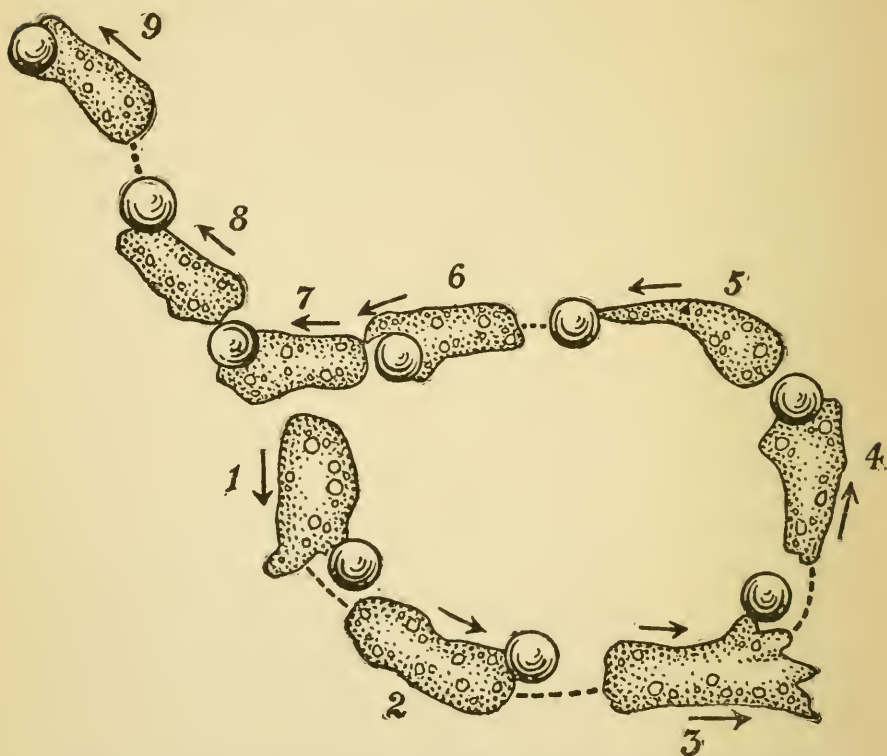


FIG. 1.—Amœba chasing and attempting to ingest an euglena. (After Jennings. From Washburn's "The Animal Mind," Courtesy the Macmillan Co.)

And just as dislike in ourselves involves our whole body, we must suppose that the vague discomfort of the amœba could not be referred to any exact spot. Its malaise probably pervades the whole of its small structure.

The positive reaction is given whenever the amœba comes into gentle contact with a solid surface or with food. Under either of these circumstances it continues to come nearer and to further its contact. The solid object is used as a surface on which to creep, and the food will call forth the third type of reaction, that of food-



FIG. 2.—Positive reaction of paramecium to pleasant contact. (After Jennings. From Washburn's "The Animal Mind," Courtesy the Macmillan Co.)

taking. Be it said to the credit of the amœba, its habits in regard to meals are marked by the utmost simplicity and informality. The process consists in simply opening up the whole body and gradually surrounding the food particle entire. The expansiveness of both the positive and the food-taking reaction correspond to the general motor effects of pleasantness in ourselves. It has

already been noted that when we are pleased every gesture and expression indicates an openness and accessibility which is just opposite of the shrinking withdrawal produced by unpleasantness; and on the basis of the same kind of reaction in the *amœba* one is tempted to ascribe to it the capacity for a vague feeling of well-being, which can not be distinctly referred to any one part of the body, although it may result from contact at one or the other side of the body.

Like the *amœba* the other simple organisms have their vague but effective likes and dislikes. The human pleasure seeker who goes to the northern summer colony and the southern winter resort, hoping to bask in a moderate temperature the year round is only doing on a grand scale what the *paramœcium* — another one-celled organism — does on a small scale. Holmes¹ found that “if *paramœcia* are placed in a trough, one end of which is heated to 35° C., while the other is placed upon ice, they will form a band near the middle where the temperature ranges from 24° to 28° C.” Marked preferences and dislikes are

¹ S. J. Holmes, “The Evolution of Animal Intelligence,” New York, 1916, p. 58.

likewise expressed in regard to the other elementary influences which so readily affect us favorably or unfavorably, such as the intensity of light, the kind of chemical stimulation, or the pressure against solid support. Vague and diffuse as we must suppose these feelings to be in the lowest animals, as indeed they are in ourselves, they may

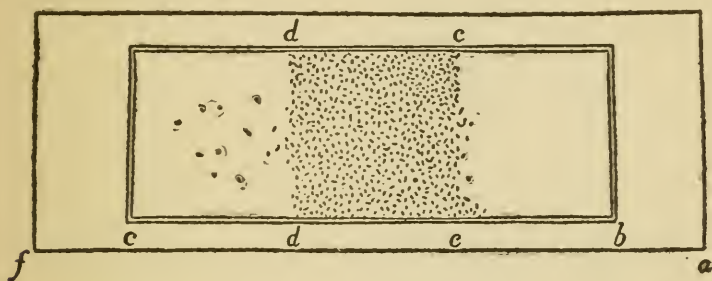


FIG. 3.—Reactions of paramoecia to heat and cold. One end of the slide is heated to 35° C. while the other end is kept on ice. The Paramoecia gather in an intermediate zone *d c*. (From Holmes' "Evolution of Animal Intelligence," Courtesy Henry Holt & Co.)

call forth the most pronounced attitudes of "willingness" or "unwillingness." Thus the liking of earwigs for the snugness of crevices is so strong that, "if given an opportunity to wedge themselves under a glass plate (they) will remain there, even when exposed to strong light,"¹ and this despite their usual dislike for light.

If we pass on to animals enough higher in the

¹ Holmes, *op. cit.*, p. 36.

evolutionary scale to have the merest rudiments of a nervous system, we seem to find the beginnings of organic gratification and distress. The indirect evidence that an animal experiences the pleasure of gratification is that his behavior seems impelled by specific cravings, such as those of hunger or sex. When an animal deprived of food for some time behaves in an unusual manner in the presence of food, it is reasonable to suppose that the satisfaction of its hunger yields it a special form of pleasure; likewise when an animal overcomes many obstacles and travels long distances in order to join company with its mate, it is hard not to believe that the sex impulse is in some measure a source of peculiar gratification to that animal.

Now actually an animal as primitive as the jellyfish shows what might almost be called a hunger reaction. That is, when it has gone unfed for some time it will leave its attachment to the bottom of the water, swim to the top, then turn over, and with its "umbrella" spread out, float slowly to the bottom, thus disposing itself very favorably for catching any food in its vicinity. This procedure of swimming to the top and float-

ing to the bottom may be kept up for a whole day by a "hungry" jelly-fish. A starfish, if kept for several days without food, will instantly perceive and crawl toward food the presence of which it would not notice when in a different physiological condition. Romanes found it possible to lead a hungry starfish about the floor of its tank in any direction simply by keeping a small piece of food within smelling distance. Moreover, animals of this type seem to make a distinction between apparent and real satisfaction from food. Thus the experiment has often been made of tricking the animals into taking in paper soaked with the juice of crab-meat. Hunger makes the animal a ready victim to the ruse but the deception is soon discovered and the spurious food rejected. This unwillingness to accept as bread "that which satisfieth not," bespeaks the capacity for a fairly definite pronouncement on the part of the digestive apparatus.

The sex impulse reaches extraordinary acuteness in insects. To cite a case from Washburn,¹ "Forel says he had a female saturnalia moth

¹ M. F. Washburn, "The Animal Mind," New York, 1913, p. 87.

shut up in his city room, and that within a short time a number of males came and beat against the window. Riley hatched in Chicago seven moths from the ailanthus silkworm, which were carefully confined. No other specimens were known to exist within hundreds of miles. A virgin female was put in a wicker cage on an ailanthus tree, and a male, with a silk thread tied around the abdomen for identification, was liberated a mile and a half away. The next morning the two were together."

The best illustration of bodily distress in the lower organisms is to be found perhaps in the case of the earthworm, an animal which, as was noted a few pages back, appears to be immune from the specific sensation of pain such as would be produced in us by lacerating the surface of the body. But let it not be inferred from the lack of "surface pain" that the earthworm is exempt from all varieties of painfulness. Prolonged and harmfully intense stimulation seem to call forth from its simple nervous system reactions that bear much resemblance to our writhing response to great internal distress which we are helpless to avoid or to relieve. Jennings has distinguished

six different degrees of excitement which can be obtained by persistently "stirring up" an earth-worm with an ever-increasing stimulus. His description of the two last degrees of excitement presents an unmistakable picture of bodily distress, as follows:

"(e) A state of still greater excitement, after long-continued and intense stimulation. Now the worm responds to a stimulus at the anterior end, that would in a resting worm cause only a comparatively slight reaction, by a rapid 'right-about-face.' [The body is suddenly doubled at its middle, so that the anterior and posterior halves become parallel, with the two ends pointing in the same direction, then the posterior half is quickly whipped about, so that the whole worm is again straight, but is facing the opposite direction from that in which it was pointed before the reaction.

"(f) A state of still more intense excitement, after repeated strong stimulation that is of such a character as to actually injure the tissues. The worm now responds . . . by lifting the anterior fourth of the body into a vertical position, and waving it about in a frantic manner. This behavior is usually alternated with the right-about-

face reactions, and with persistent rapid crawling backward and forward.”¹

The behavior above described has so much in common with our own reactions to violent bodily distress that we must conclude that the earthworm, for all his indifference to being cut in two, has a fairly well developed organic sensitivity of some kind. It will be remembered that the human stomach, intestine, kidneys, etc., are absolutely irresponsive to the surgeon's knife, but that when disordered in function they may easily become sources of excruciating agony. It would seem that the earthworm's capacity to experience pain is about on a par with that of our own vital organs. This conjecture is further supported by the fact that the special nervous system which supplies the viscera — the so-called sympathetic nervous system — is a much more primitive affair than the nervous system proper, by means of which we see, hear, feel surface pain, etc. The former is a diffuse system of nerve fibers and ganglia not wholly unlike the rudimentary nervous system of the earthworm; it is more adapted for communicating the vague aches of disordered organs than the

¹ Quoted from Holmes, *op. cit.*, p. 148.

exact pains from the surface of the body. [The fact that the earthworm has this kind of nervous system, and that its behavior gives indications of distress, but not of pain, makes it a plausible conjecture that we have in it an example of the second stage in the evolution of pain; namely, the stage which implies a capacity for limited unpleasantness and for organic distress.

It is impossible to say exactly at what point one can first begin to trace evidences of the experience of surface pain and of tickling, but two general statements may be made with a fair show of reason:

First, pain and pleasure do not appear as clear cut and definite sensations except in animals with "central" nervous systems, i. e., with something of a brain and spinal cord connection.

Second, pain as a sensation, has been much more fully developed than has pleasure. It is a much more constant sort of psychic fact throughout the animal series than is tickling. In the struggle for existence it was obviously much more important for an animal to know what not to do in order to avoid trouble than to know what to do in order to afford itself pleasure. Consequently we find

that all of the higher animals, i. e., those with cerebro-spinal nervous systems, react in very much the same manner to an injury to the skin, whereas the reaction to tickling pleasure varies widely from animal to animal and from individual to individual.

The possession of a surface pain sensation together with a central nervous system has given the higher animals a double advantage in the struggle for existence. Surface pain sensitivity means that the animal will be aware of danger before the wound has become vitally serious, and the possession of a brain means that pain-causing objects will soon be taken for what they are and left scrupulously alone. A species thus equipped with special pain receptors and with special faculties for learning by experience may continue to exist and prosper in a rigorous environment even though the number of individuals be small. The lower animals are obliged to make up in fertility of offspring what they lack individually in equipment for guarding against the painful. As James ¹ has expressed it, "those fishes which are no sooner thrown back from the hook into the

¹ James, *op. cit.*, p. 99.

water than they automatically seize the hook again, would soon expiate the degradation of their intelligence by the extinction of their type, did not their extraordinary fecundity atone for their imprudence." It is still a moot question what sort of nervous change takes place when the burnt child learns to dread the fire, but it is evident that brains and a specific pain sensation take their places together as the peculiar birthright of those beings whose individual welfare is relatively precious. It is almost as if Nature — to use the term personally — had discovered, after many biological experiments, that life could be administered more economically by having a few individuals equipped with pain and brain than by a mere prodigal output of painless and unteachable creatures left to take their chances in a world full of mischance.

Tickling, even in human beings, shows an inconstancy and unsteadiness that stand in marked contrast to the insistence and unvarying steadiness of pain. As it is more vitally important to be able to avoid the hurtful than to seek the agreeable, we may well expect to find that tickling is a late acquisition and not even yet possessed of the

stability of a full-fledged sensation. There is, however, considerable evidence that the animals just below ourselves in the scale of intelligence are capable of being made to "laugh" by means of the sensory effect of tickling. Darwin speaks of anthropoid apes giving out "a reiterated sound, corresponding with our laughter, when tickled, especially under the armpits."

Dogs derive endless pleasure from the many varieties of mild friction of the skin. A gentle patting and rubbing will usually produce a slow wagging of the tail, which is the dog's most natural smile. People well acquainted with dogs are, according to Hall and Allin, almost unanimous in their verdict that the dog draws back the corners of his mouth if tickled in the ribs and thus literally and physiologically "smiles." When the tickling is somewhat sportively administered, dogs are likely to have their "funny streaks" and to "run around in a circle, sometimes showing their teeth in a peculiar way, perhaps lifting the upper lip when they play with children they know, but never with strangers."¹ With dogs as with

¹ Hall and Allin., *The Psychology of Tickling and Laughter*, *Am. J. of Psych.*, 1898.



(C) Underwood & Underwood

FIG. 4. — A laughing chimpanzee

human beings it is the friendly hand that tickles most, or at least most pleurably. The cat is much more impersonal in its preferences as to who shall do the tickling and rubbing. Any well-tamed cat will arch a comfortable back for any inoffensive person who chooses to stroke her. Tickling proper is readily obtained from cats by light intermittent touches about the face and throat, and ordinarily calls forth a spirited form of friskiness, in which the close relation of tickling to mock injury is especially evident.

Horses, lambs, etc., although they give conspicuous evidence of the sheer joy of living, as when they jump, snort, paw and roll about, never seem to get beyond the stage of organic gratification. Tickling appears to be a distinctly unpleasant experience for them. If one tries a light touch with the tassel of a whip the only response provoked will usually be a general quiver or shudder such as we would give in response to a vexatious treatment of our skin. Thus it appears that while surface pain is an endowment of at least all of the vertebrates, the pleasure of tickling is limited to a very few of the highest vertebrates, notably the cat, the dog, and the monkey,

and is a quite variable experience even among them.

The late development of surface pain and ticklishness in the animal series is paralleled by their lateness in appearing in the human infant. Though babies cry abundantly as a result of organic discomfort of various sorts, it seems that for weeks, and even months, they may be — like animals far down in the scale of evolution — not painfully aware of any laceration of the skin. The writer knows personally a case in which the mother of a baby of four months in dressing her child unwittingly penetrated the infant's skin with a safety pin in such a manner that the fastening included a pin length of outer surface skin. The baby, though left in this way for ten hours, made not the slightest outcry throughout the day. The same mother reports that in cutting her child's finger nails she has occasionally pricked the finger and even drawn blood without any noticeable response from the baby. The exact time of appearance of the pain sensation probably varies as widely in different individuals as do the times of learning to talk and walk, but it is at least not present at birth, and may not appear for months.

Tickling also develops very gradually, first one and then another zone becoming ticklish. A four months' old baby which will giggle as a result of being tickled about the neck, may fail to display any such sensitiveness when the soles of its feet are concerned. When he is a few months older, these latter may be the most ticklish parts of his body.

Summary

To sum up what has been said in the present chapter: It has been found that pain and pleasure as sensations have probably been evolved gradually out of a primitive obscure state of well-being or pleasantness and malaise or unpleasantness. The three distinct stages of development for which we found evidence were:

(1) *The primitive stage of pleasantness — unpleasantness itself, which apparently exists in some fashion in all animals, even down to the one-celled organism such as the amæba.*

(2) *The next stage was that of bodily gratification and distress, the kind of pleasure-pain experience which we get from our inner organs. These states seemed to be discoverable in those*

animals just beginning to develop a rudimentary nervous system of the same general type as the "sympathetic nervous system" which supplies our inner organs. Animals of many cells but invertebrate, such as the earthworm, were seen to offer an excellent example of the capacity for bodily distress without the possibility of pain proper.

(3) *The last stage was that of surface pain and ticklishness. This stage implies the possession of a fairly well developed central nervous system, and may be said roughly to include the vertebrate animals, except that ticklishness is the unique possession of the highest vertebrates and is very unevenly present even among them.*

CHAPTER IV.

THE MEANING OF PAIN AND PLEASURE

IN order to form an adequate notion of the essential character of pain and pleasure it will be necessary for us to refer constantly to two facts, both of them sufficiently obvious, but too often lost sight of in the present connection. These two facts are (1) the readiness with which pleasure goes over into pain and pain into pleasure, and (2) the connection of both states with the struggle for existence.

The first fact,—the ready interchangeability of pain and pleasure when conditions are slightly changed,—is one which can be abundantly illustrated from any department of life. [The same hardship that is the chief delight of the well trained and athletic person is utterly intolerable to one fatigued or lacking in physical strength. For the former the violent exertion of climbing a mountain is sheer joy, and he would find nothing

more unendurable than the absence of all exertion. The latter is continually on his guard against having to tax his powers. He can hardly represent pleasure to himself except as consisting of flowery beds of ease; and by the same token pain is for him practically synonymous with vigorous effort.

Moreover, it is possible that the same task may appear at one moment painful and at another pleasurable to the same man, not as the result of any change in his physical condition, but according to whether he adopts the attitude of work or play. The same tasks which the average man abhors to perform as household chores form the chief joy of picnicking or camping out. With remarkable avidity he bears his share of carrying the packs or building the fire, when it is all done just for the fun of it. In the same way the exercise of dancing may be enjoyed even by frail young ladies on the point of physical exhaustion, although it would be excruciating torture to these people, if prescribed to them by a physician, and in the form of calisthenics to be gone through just after rising and before going to bed. It is more than the mere perversity of human nature which makes it

possible for the tired shop girl to find in the dance hall recreation from the footsore weariness caused by a long day's work.

Further than this, the outward expression of pain and pleasure has some connection such that the two may be confused in persons of nervous instability. The following cases, mentioned by Hall and Allin,¹ illustrate strikingly this tendency, especially on the part of immature or hysterical persons: "A company of young people, of both sexes, from 19 to 24, were sitting together when the death of an acquaintance was announced. They looked at each other for a second and then all began to laugh, and it was some time before they could become serious." "A frontiersman in a well-authenticated case, came home to find his dearly beloved wife and children all lying dead, scalped and mutilated by Indians. He burst out into a fit of laughter, exclaiming repeatedly, 'It is the funniest thing I ever heard of,' and laughed on convulsively and uncontrollably until he died from a ruptured blood vessel."²

To go a step further, it can be said without

¹ Hall and Allin, *op. cit.*

² *Ibid.*

exaggeration that our profoundest pleasures are those which have the nearest relation to possible or actual pain. [The very horror of falling off a great height or out of a swiftly moving vehicle furnishes the background for the intense thrill in taking daredevil chances with an aeroplane or automobile. The painful start of fear which any child gives in response to a sudden change in his surroundings is of a piece with the acute delight that he gets from the friendly Boo! of those who make believe with his fears. It is the painful emotions of fear and pity which, when skillfully played upon, afford the extraordinary joy that the theater lover derives from tragedy. In this special case the direct contemplation of tremendous sadness or gruesome frightfulness may leave the spectator sighing deep with the contentment of a really edifying experience.

[The same ready interchangeability of pain and pleasure is observable when we note some of the characteristic effects that result from the lapse of time. An embarrassing social blunder, which covers one with mortification at the time of its occurrence, may within a few weeks become a never failing source of laughter and pleasure as

one reflects on it afterward. Perhaps he may even bore his neighbors with the frequent recounting of the incident which he now enjoys so heartily. Joy in the memory of past griefs is a fact remarked on by Homer, whereas Dante was especially impressed with the painful memory of past pleasures, saying that the greatest sorrow was to recollect one's happier time when in misery.

The cases mentioned so far have had to do more with pleasantness-unpleasantness than with surface pleasure and pain, but the same general statement will be found to obtain for these states. We have already seen that the ticklishness of a given part of the body varies directly with the vulnerability of that part, and that tickling when overdone becomes distinctly disagreeable or painful. Further than this, surface pain sensations, when very faintly experienced, may be productive of the greatest pleasure of which the skin is capable. Thus the pleasure of picking a partly healed scab is so alluring that children have been known to make cuts on their hands for the definite purpose of creating a scab. Tearing away a fragment of slightly sensitive callous skin is another of the "real sports" of childhood. But it is the

faint pain of scratching an itching area which is preëminent in this respect. "You scratch my back and I'll scratch yours," is the homely adage based on the peculiar satisfaction that this mildly painful treatment of the skin affords.

It appears then that from whatever angle we begin our consideration of pain and pleasure, we find everywhere abundant illustration of the fact of ready interchangeability. Both of them seem to issue from the same general circumstances; when pain issues, it is only because of an excess of the same conditions which when less extreme result pleasurable. What are these conditions?

In order to answer this question we shall have to make mention of the second of the two facts referred to at the beginning of the chapter, i. e., that life is inevitably a struggle. A ceaseless conflict between an environment that imposes obstacles and an organism that tends to pit itself against obstacles,—this is the fundamental condition of life, and there are no other terms at which it is to be had. Whether we think of our bodily existence as a struggle between the forces making for growth and those making for disinte-

gration, or whether we think of our personal life in society as a competitive struggle in which each individual is spurred on to render a good account of himself, the reflection is continually forced on us that without strife there can be no life. As soon as any part of the body is freed from the performance of its tasks, it begins to atrophy; as soon as any individual proves his unfitness to cope with the conditions that surround him, he is immediately reckoned as of no account; and when an institution ceases to find things worth fighting for we ask what is its reason for being. Born as we are to a world of this sort it is only natural that we should enter it equipped with an abundance of active dispositions. To a world which demands effective responses we bring more or less ready-made tendencies to respond, all of them waiting for the appropriate occasion when they may be brought into play. Thus prepared with innumerable impulses, desires, reflexes and instincts, we venture out into endless enterprise, some of which is to be attended by success, some by failure. When our activity arrives at its end, i. e., encounters successfully the conditions it was

designed to meet, we experience pleasure.¹ When, in spite of our utmost resource, the demands made of us cannot be met, we experience pain. For example, a keenly contested game brings to the victor a pleasure he could not have known if his rival had not been a worthy match for him. And vice versa, to be defeated at the hands of an acknowledged rival, who challenges our utmost effort, this is indeed to drink the cup of bitterness.

[To state the same point in somewhat different language, one may say that all pleasure and pain center about the efforts of a living organism to further its development. Such an organism refuses to rest satisfied with what it has attained, and strives not only to hold what it has attained, but continually to add new worlds to those already conquered. Any given state of equilibrium is therefore indifferent or even positively painful if too long maintained. Enforced idleness soon brings with it the pain of boredom to an organism ready for the fray. Not a few business men who have retired at a ripe old age have found it necessary to go back to die in harness. Business capac-

¹ See W. Fite, "The Place of Pleasure and Pain in Functional Psychology," *Psychol. Rev.*, 1903, X, 633-644.

ities ready at hand and "stripped for racing" brook no check except at a cost of pain. It is evident then that *within certain limits all disturbance of equilibrium is pleasant*. The trained athlete "rejoicing as a strong man to run a race" makes a wide departure from the ease of the arm-chair, but counts his exertion a pleasure. It is equally obvious, however, that *there are limits beyond which all disturbance of equilibrium is painful*. The agonized expression of the runner who has punished himself too severely stands in marked contrast with the buoyancy of his better trained opponent. No matter with what zest we enter upon any form of activity there is a point beyond which it becomes intolerable. The organism's task under such conditions is to restore the excessively disturbed equilibrium. It is only in this way that it can cope further with environment, and accordingly it is recuperation that is now pleasurable. The struggle in such cases assumes a different character; it is a struggle to recover normal fitness, and though it is marked by no outward signs of striving, in reality certain vital processes are functioning to an unusual degree. Thus it is possible for the mountain-

climber to derive keen pleasure both from his exertion in the morning and from his rest in the afternoon. One is the pleasure of activity; the other is the pleasure of preparation for activity. Both types, different as they seem, depend on the efficient operation of active tendencies.

[To sum up, *all forms of pain and pleasure revolve about the fact of conflict.* Pain may arise either when the struggle makes excessive demands on us or when our powers, ready for activity, are denied the opportunity for employment. Pleasure may arise either from carrying on a struggle equal to our powers or from restoring equilibrium by rest after a severe struggle. It remains to apply the above account to the varieties of pain and pleasure which were described in the first chapter.

Pleasantness and Unpleasantness

We may begin with the cases of pleasantness and unpleasantness. Especially instructive here are the instances of acquired tastes. When a man is persuaded by his friends to learn to eat olives or drink beer, neither of which he likes at first, but which finally come to be numbered among

his favorite indulgences, we may account for the change, according to our explanation by saying that these bitter tastes, with each successive adaptation have produced a less violent palatal disturbance, until finally they have come within the range of disturbances against which the palate is able to pit itself. Thereafter they afford the relish of something difficult, but not too difficult.

The same sort of process is probably at work when we acquire a liking for music which at first hearing seemed intolerably harsh and dissonant. Any one in the least familiar with the history of music knows how every great master has outraged the tender feelings of critics of his day. The music that we most enjoy to-day would have been laughed out of court as unspeakably disagreeable two hundred years ago. More and more dissonant intervals have challenged the ears of each successive generation, and while each new innovation has created confusion and unpleasantness, it has been gradually mastered by the music-going public, which now demands that music be complex and even harsh in order to be enjoyable. Wagner had to struggle to persuade the world to endure harmonies which are to-day a chief re-

source for popular nights at the symphony. The challenge which Wagner's orchestration bears to our ears still disturbs our auditory equilibrium, but we delight in going forth to meet the disturbance. It is within the range of our power to cope with it.

Everything depends on whether the force called forth in ourselves is adequate to the demands made of it. So long as it is, there is no limit to the amount of disturbance which may be pleasant. The more keenly contested the struggle, the more enjoyable is the winning of the victory.

We are now in a position to understand why a slight difference in bodily energy may make such a vast difference in our feeling attitude toward the same object. For the sick or weary man no form of strenuous activity is tolerable, because every effort compels him to overdraw his reserve. To one who is brimful of energy every struggle is a delight, because he is more than able to maintain himself. For the same reason any new access of energy may convert an unpleasant into an extremely pleasant experience. How often, for example, does one who dreads some social event or public performance find his dread changed into

sheer delight as the result of a stimulating cup of coffee! How often, also, is an article of dress that one dislikes personally, accepted with joy as a result of the knowledge that everybody is wearing that style! Our effort when backed up by the powerful force of social suggestion can be made to cope with even the extreme hobble skirt or the ultra-modern dance. Vice versa, our personal preference for a certain style of dress survives with difficulty the edict of fashion that taboos such a style.

The case of the picnicker's delight in gruesome toil now appears as merely a special instance in which the instinct of play has availed him of an extra supply of energy. Furthermore, it is now quite comprehensible that the painful fear of real danger should be so readily converted into the pleasant thrill of near or make-believe danger. The child begs to be half startled with a boo! because the mild shock is within the scope of his powers of resistance, and is therefore pleasurable. The same explanation obtains for the aviator's devilry and for the pleasing effect of fear and pity in tragedy. For the same reason also a sudden change from a flippant to a sober mood may

make us turn with more relish to aching toil than to gay triviality. One who has girded up his loins does not cope with difficulty on quite the same terms as does one supine with "paunched ease."

The notion that pleasure results from conflict adequately prepared for also renders it intelligible that past griefs may become pleasant. In memory all things are likely to lose in intensity, and the grief that overwhelms us in its actual occurrence might very conceivably mellow into a faded image of sorrow against which there is a certain pleasure in pitting one's self because the difficulty has been so far reduced.

The confusion of the outward expressions of pain and pleasure, as when one laughs at distressing news, we must suppose to be due to the fact that the shock has summoned forth even more energy than is normally to be expected. When such unusual laughter goes over into profound depression, we have but the natural reaction against the original excess. An interesting case in which we are able to observe a sudden change from amused pleasure to anxious concern is that in which we discover that the victim of a laugh-

able fall has seriously injured himself. Here the joy which comes in contrasting our own security with the humiliation of the man we laugh at is forced out by the intense pang of sympathy which is more than a match for us.

The conception of life as a progressive conflict for which we are equipped by nature leads us to the discussion of two further points,— (1) the indifference of habitual acts and (2) the painfulness of repressing activities normally seeking expression. The former is too obvious to require elaboration. It is exemplified in every routine act of our life. Every act which becomes so habitual as to be performed with ease ceases to afford pleasure or even consciousness. When we have become expert at bicycling or typewriting or playing the piano we are obliged to set ourselves new tasks or lose the joy in the performance of these acts. We have acquired a facility which requires a very considerable activity for its full employment.

The unpleasantness of thwarted activity is another instance of the need of allowing ample occasion for the exercise of native or acquired tendencies. When we take on a match at tennis

with a player we suppose to be skillful, but discover shortly that he is the merest novice, the unpleasantness of ennui at once begins to set in, and unless we are able to divert ourselves by thoughts remote from the present occupation, we are in for an unhappy half hour. Our capacities for successful struggle of this particular form have been aroused only to be thwarted. Prepared for action we have no occasion for activity. All of the unpleasantness of monotony or boredom is of this same general type. In a passage quoted by Stout ¹ from Brown's "Philosophy of the Human Mind" the following question is asked: "What patience could travel for a whole day, along one endless avenue, with perfect parallelism of the two straight lines, and with trees of the same species and height, succeeding each other at exactly the same interval?" And it is pointed out that "what we should feel with most fretfulness would be the constant disappointment of our expectation, that the last tree which we beheld in the distance was the last that was to rise upon us; when, tree after tree, as if in mockery

¹ G. F. Stout, "Analytic Psychology," London, 1896, Vol. II, p. 274.

of our very patience itself, would still continue to present the same dismal continuity of line." [The above is a single instance of capacities for activity denied their natural outlet.

The pain of bereavement is to be understood in the same way. To quote again from Stout:¹ "The person taken from us has formed part of our life. So far as this is the case, his removal means the repression of our previous modes of thought and action. While the loss is recent, these preformed mental tendencies are stimulated by everything which can remind us of the deceased; but they are stimulated only to be crushed." Indeed, one need not have known any real sorrow in order to experience this kind of thwarting. To mislay a watch that one has carried for years may cause an uncomfortable feeling that lasts for days. Each mention of the time of day will provoke an incipient start for the watch pocket, followed by an acute annoyance because there is no end to be attained by the accustomed form of activity.

¹ Stout, *op. cit.*, p. 278.

Bodily Distress and Gratification

To turn now to the pain and pleasure connected with the functioning of the inner organs, we find once more that the same general principle holds good. Bodily distress is always due either to the violent disturbance of some organ or else to the baffling of some organic craving. As examples of the first we have all of those cases of disordered functioning which make up the long list of aches, cramps, colics, etc. In all of these instances the organism finds itself confronted with excessive demands. If the surgeon even by cutting and pinching the stomach, fails to call forth any pain, that is because the stomach has not had an evolution which leads it to concern itself on such occasions. [The stimulus of cutting calls forth no effort on its part to ward off such an attack. But the presence of indigestible food in the stomach may produce colicky pain, because such a stimulus calls forth its utmost effort, and when this effort fails there results the peculiar quality of internal bodily pain.

The nature of organic craving is also clearly illustrated in the case of the stomach. Its capac-

ity for aiding in the digestion of food may be the occasion for pain if the capacity is too long denied adequate employment. The contractions which proceed comfortably in the moderately filled stomach produce the gnawing pangs of hunger, when they take place in an empty stomach. An experiment by Cannon and Washburn¹ has very neatly demonstrated this point. To quote from their account: "In order to learn whether such proof might be secured, one of us (W.) determined to become accustomed to the presence of a rubber tube in the œsophagus. Almost every day for several weeks W. introduced as far as the stomach a small tube, to the lower end of which was attached a soft-rubber balloon about 8 cm. in diameter. The tube was thus carried about each time for two or three hours. . . . When a record was to be taken, the balloon, placed just below the cardia, was moderately distended with air." After this preliminary practice, "on the days of observation W. would abstain from breakfast, or eat sparingly, and without taking any lunch would appear in the labora-

¹ W. B. Cannon and A. L. Washburn, "An Explanation of Hunger," *American Journal of Physiology*, vol. 29, 1911, p. 449.

tory about two o'clock." With recording apparatus arranged the experiment proceeded, and "when W. stated that he was hungry, powerful contractions of the stomach were invariably being registered. The record of W's introspection of his hunger pangs agreed closely with the record of his gastric contractions." Here is simply a new application of our pleasure-pain principle. [The normal activity of the stomach demands its normal exercise. If it is baffled in the realization of its appropriate ends, pain ensues. The thwarted stomach bereft of its food takes its place with the other cases of baffled expectation and demonstrates further that pain may be due either to the violence of the disturbance or to the futility of a readiness that is not allowed expression.

The pleasure of eating a hearty meal is, by the same token, due to the putting forth of a considerable digestive effort when the stomach's readiness is likely to be equal to the task imposed upon it. Gastric preparedness like military preparedness likes nothing so well as the assimilation of adequate prey.

The other forms of bodily distress and gratification are in every way comparable to the above.

The lungs may suffer from a local disturbance, as in pleurisy, or from a general thwarting of activity, as in suffocation; the circulation may suffer from an excessive start when an emotional shock is experienced, or it may cause acute pain when the normal activity is obstructed as in angina pectoris; and our nervous system as a whole may render us uncomfortable either on account of great strain or on account of repressed desires.

Surface Pain and Pleasure

A cut finger brings about very definite and violent movements designed to defend our skin against further harmful inroads. But no matter with what alacrity we respond, the best we can do is to prevent further damage; we have no effective counter stroke which at once rights the wrong already done. The disturbance is excessive in that we are not adequately equipped with any activity tendency that is a match for it, and the inevitable result is pain. If, however, the disturbance is very slight, and can be completely relieved by some such activity as scratching, we have a really agreeable experience. The pleasure of tickling we saw to be related in all probability

to the vulnerability of the parts tickled. Like playful fear this make-believe injury to the skin depends on the fact that the attack is something we are able to cope with. The disturbance merely threatens to become painful, and the normal defensive reaction, if successful, is quite capable of affording protection before harm is done. Within such limits it is to be expected that the more violent the outward behavior of the person tickled the more intense will be the thrill of pleasure that comes from entering into the struggle. The child who writhes and squirms is probably much nearer to the point of accepting the make-believe attack as a serious threat; he accordingly pitches the conflict at a high level of intensity, and hence derives keener pleasure from the whole performance.

' Cases where pain is caused by the thwarting of activities connected with the skin are somewhat harder to list, but every one has had the experience of having a pain become much more severe on account of his being unable to move in response to it. Even an itching that cannot be scratched soon tries our self-control to the limit. If one were given his choice between a toothache

to which he was free to minister, and an itching back that he was not allowed to scratch, it is probable that his choice would incline toward the former.

Summary

We have seen that all three varieties of pain and pleasure described in the first chapter can be best accounted for by reference to the fact that every living organism is born with the capacity for struggle, and in an environment where struggle is a fundamental law of nature. Pain signifies either that the environment has demanded too much of the organism's limited capacities — the pains of excess, or that it has failed to offer a point of contact for unused activity tendencies — the pains of thwarting. Pleasure signifies either that the environment has furnished occasion for a conflict to which the organism's powers are equal — the pleasures of activity, or that opportunity is being afforded for recovery from a struggle carried to an extreme point — the pleasures of rest.

CHAPTER V

THE BODILY EFFECTS OF PAIN AND PLEASURE

THE popular notion in regard to the bodily effects of pleasure and pain has it that in some way or other pleasure always tends to make our bodily machinery more efficient, and pain less so. While this notion has a considerable measure of truth in it, it falls far short of being an adequate statement of the case. Let us consider, for example, the implication that the immediate effects of the two are necessarily opposite. Far from this being the case, it is actually a fact that our most extreme pleasures have the same kind of immediate bodily result as does pain. This would naturally follow according to the view set forth in the preceding chapters, to the effect that the most vivid pleasures represent some sort of hard fought struggle which we have been fortunate enough to maintain successfully. We may best

judge of the facts by taking some well-known pain-effect, such as the production of sugar in the urine, and observing whether the same effect is produced by a violent form of pleasure.

An opportunity for such an observation is to be had in connection with intercollegiate athletics. It needs little argument to prove that for the large majority of college undergraduates the one day of the year most supreme with pleasure is the day of the "big game." To quote from Dr. Cannon's description of this event,—“There is practically a holiday in college and to a large extent in the city as well. The streets are filled with eager supporters of each team as the hosts begin to gather at the field. As many as 70,000 spectators may be present, each one tense and strongly partisan. The student bands lead the singing by thousands of voices of songs which urge to the utmost effort for the college. . . . Into the midst of that huge, cheering, yelling, singing, flag-waving crowd, the players are welcomed in a special outburst of the same demonstration of enthusiasm.”¹ To quote the same author further,—

¹ W. B. Cannon, "Bodily Changes in Pain, Hunger, Fear, and Rage," New York, 1915, p. 220ff.

“ In the dressing-room before a critical contest I have seen a ‘gridiron warrior,’ ready in canvas suit, cleated shoes, and leather helmet, sitting grimly on a bench, his fists clenched, his jaws tight, and his face the color of clay. He performed wonderfully when the game began, and after it was over there was a large percentage of sugar in his urine.” Further than this, we are informed that the observation taken on an excited spectator in the Harvard-Yale game of 1913 showed a marked increase of sugar in the urine.

To take still another effect which one most naturally attributes to extreme pain,—namely, collapse. There is abundant possibility of collapse from pleasure, either if the pleasure is very exciting or if the individual is very sensitive. Dearborn, in the “Influence of Joy” cites the case of Lucretia Davidson, the precocious American poetess who died at the age of seventeen. “Her susceptibilities were so acute, and her perception of beauty so exquisite, as to cause her to faint when listening to some of her favorite melodies from Moore. Yet notwithstanding this serious impression, she would beg to have them repeated,

so delicious were the sensations produced.”¹ Here then is evidence that conspicuous pain effects may be produced by supreme pleasure. It will be necessary, therefore, in making statements regarding the bodily effects of pleasure, to distinguish the milder and more restful pleasures from those marked by extreme activity.

Another point which should not for a moment be lost sight of is the difference between immediate and final effects. For example, an obvious immediate effect of pain is a quickening of bodily activity. Darwin's oft-quoted “Expressions of the Emotions in Man and Animals” contains this statement: “In the agony of pain almost every muscle of the body is brought into strong action; great pain urges all animals, and has urged them during endless generations, to make the most violent and diversified efforts to escape from the cause of suffering.” But when we consider the effects of pain in the long run we are obliged to think of it as depressing. Synonymous with sorrow and woe, it always calls up a picture of physical inadequacy.

¹ G. V. N. Dearborn, “The Influence of Joy,” Boston, 1916, p. 96.

In the limited scope of the present chapter we shall confine our discussion largely to those bodily effects which immediately appear as the result of pain and pleasure, and we shall refer chiefly to the milder pleasures. Two vitally important bodily effects will occupy our attention, those of digestion and of circulation.

Effects on Digestion

The first step which the body takes in the direction of effective digestion is in starting the secretion of saliva. "Fletcherism" has at least done something toward educating the general public to the importance of beginning nutrition with an abundance of this first aid to digestion. Generally speaking, it may be said that whatever causes the mouth to water is insofar a help to digestion, and that vice versa, any slowing up of this secretion will render digestion so much more difficult. Now it is a pretty clearly established fact that pleasant associations of any kind tend to make the moistening of the mouth proceed easily, whereas pain and unpleasantness make it difficult or even impossible. So regular is this connection that some savages, as for example the

Australians, express admiration by smacking and clacking the mouth. Children often add to the expression of their joy by various gurgling and trickling sounds; and even in adults the warm smile always carries with it a certain suggestion of moistness. A dry mouth, on the contrary, is a fairly constant accompaniment to marked unpleasantness. It is for this reason that a mob is secretly impressed upon noting that the intended victim can stand and spit at those who would terrorize him. They realize that such an abundance of saliva would be impossible in a man afraid. Indeed, one well-known ancient method of determining guilt in a suspect was to try his power to produce saliva. In the ordeal of rice, employed in India, the judges assumed that the innocent man would have a normal flow, whereas the real culprit, wrought upon by his guilt, would have a dry mouth. The method of trial was therefore to have all of the suspects chew the consecrated rice and, after a time, spit it out upon a fig leaf. Whoever returned the rice dry was adjudged guilty, because it was supposed that the stopping of the secretion indicated the knowledge of guilt and fear of discovery.

After salivary secretion the next important process in preparation for digestion is the secreting of gastric juice. And here again we find a very definite antagonism between pain and pleasure effects. Almost every one has noticed more or less clearly that in some strange way food eaten under pleasant surroundings is assimilated with more than ordinary ease, and without harmful after effects. The German beer-garden and the French café chantant flourish for this reason. In our own dyspeptic country this knowledge has been capitalized on an extravagant scale. The dominant theory of the big New York hotel to-day is that rich patrons will spare no price if every consideration of elegance, daintiness and personal comfort is provided in addition to good food.

Pawlow, the noted Russian physiologist, has abundantly demonstrated in his experiments on dogs that a pleasurable food idea causes the stomach to begin watering, even though the food never reaches the stomach. Two details of this experiment will be necessary for a clear understanding of the point under discussion. For one thing, a device was provided which enabled the experimenters to count the drops of gastric juice for a

given interval of time. Another essential point was that the food eaten and swallowed by the dogs was in some cases not allowed to reach the stomach, but passed out through an opening artificially made below the throat. Whenever a dog was allowed the quiet pleasure of eating undisturbed for five minutes,—a procedure called “sham feeding” by the experimenters, because the food never reached the stomach—the gastric juice flowed in abundance, and as much as 67 cubic centimeters would sometimes be produced during twenty minutes. If however, any unpleasant emotion were allowed to intrude itself on the dog’s peace of mind, a most remarkable lowering of gastric production was the result. To quote from Cannon’s¹ description of such a case: “On another day a cat was brought into the presence of the dog, whereupon the dog flew into a great fury. [The cat was removed and the dog pacified. Now the dog was again given the sham feeding for five minutes. In spite of the fact that the animal was hungry and ate eagerly, there was no secretion worthy of mention. During a period of twenty minutes, corresponding to the previous observa-

¹ W. B. Cannon, *op. cit.*, p. 11.

tion, only nine cubic centimeters were produced." Thus the gastric juice secreted in the stomach under normal conditions of eating is more than seven times as great as under conditions of emotional stress! Well might Solomon write — "Better is a dinner of herbs where love is, than a stalled ox and hatred therewith."

The disturbance of gastric secretion does not require any such fury of excitement as in the above instance. The direct stimulation of a pain nerve is most effective, and even the discomfort of a dog in new surroundings, or his annoyance at being tied, will often suppress the gastric flow. In children mere vexation at not being allowed to eat when they want to may render them incapable of digestion even though hungry.

A third important part of the total process of digestion is what may be referred to as the mechanical factor, *i.e.* the contractions of the stomach and intestines. This is the final process by which food is carried from one region to another in the alimentary canal. On this depends the assimilation of food, which has passed through the preliminary stages of digestion. When this movement ceases, food inevitably stagnates. The

conclusions reached by Cannon in this department of digestion parallel in significance the experiment by Pawlow relating to gastric secretion. Again we find the same point for point antagonism between pleasure and pain effects. All things unpleasant tend to check the peristaltic waves; all things pleasant tend to further them. Even such a slight emotional difference as that between the restiveness of the male cat and the calmness of the female cat when tied shows a corresponding difference in gastric peristalsis. The animals in the experiments referred to were restrained in a holder in order to be examined with Röntgen rays. "Although the holder was comfortable, the male cats, particularly the young males, were restive and excited on being fastened to it, and under the circumstances gastric peristaltic waves were absent; the female cats, especially if elderly, usually submitted with calmness to the restraint, and in them the waves had their normal occurrence." ¹

That specific bodily distress has the same effect here as general unpleasantness, appears from the fact that the gastric contractions could always be

¹ W. B. Cannon, op. cit., p. 14.

stopped by shutting off the cat's breath for a short time. These facts observed in animals give the clue to the feeling of heaviness so often complained of in dyspeptics. The connection between such stagnation and unpleasant or painful ideas is clearly seen in the following case.¹ "A refined and sensitive woman, who had digestive difficulties, came with her husband to Boston to be examined. They went to a hotel for the night. The next morning the woman appeared at the consultant's office an hour after having eaten a test meal. An examination of the gastric contents revealed — the presence of a considerable amount of the supper of the previous evening. [The explanation of this stagnation of the food in the stomach came from the family doctor, who reported that the husband had made the visit to the city an occasion for becoming uncontrollably drunk, and that he had by his escapades given his wife a night of turbulent anxiety. The second morning, after the woman had had a good rest, the gastric contents were again examined; the proper acidity was found, and the test breakfast had been normally digested and discharged."

¹ Ibid, p. 17.

Thus the story of the effect of pain and pleasure on digestion is one that is simply told, for the effects are direct and constant. The practical deductions are therefore so plain that he who runs may read, and yet unfortunately their plainness does not guarantee the reading. Their importance is, however, inconceivably great. Dearborn has aptly said that dyspepsia in the long run is more momentous than war. Year in and year out its destruction probably amounts to even more, and yet it is certain that a very large per cent. of its ravages could be eliminated by a rigid enforcement of the following rule:—*Always force yourself to go without food rather than eat when annoyed, anxious, hurried, or in severe pain.*

Efficacious as this simple régime would undoubtedly be, it is amazingly hard to put into effect in everyday life. One of the many things that die hard is the illusion that having eaten means being fed. A safety first campaign directed toward dispelling this illusion would rank in public service with any of the welfare movements which social workers have fostered. The business men's luncheon is probably the meal at which the soul is most consumed along with the food. If soul-

gnawing is a necessary feature of noon life in a metropolis then a glass of water is the ideal luncheon of the future. Perhaps an increased skill in relaxation may be made to save the day, but if not, the alternative is plain.

The relation between pain and digestion will serve to make clear one further point. The readiness of the neurasthenic to find in his stomach a prolific source of trouble can hardly be a matter of surprise. Whatever the original character of his difficulty, fancied or real, it would take no great amount of disagreeable thinking to have a substantial effect in thwarting digestion. When eating proceeds under these conditions the way to real trouble is not far ahead. What per cent. of dyspepsia is "nervous" it is difficult to say, but it can be readily seen that there is practically no limit to the power of pleasantly or unpleasantly toned ideas to further or hinder the assimilation of food.

Effects on Circulation

It is the circulation which immediately avails us of whatever vital resources we have. And as pain always means that conflict is on in real earn-

est, it necessarily carries with it a hurry up call for activity of the circulation in special directions. In the interest of making mighty efforts, it is nec-

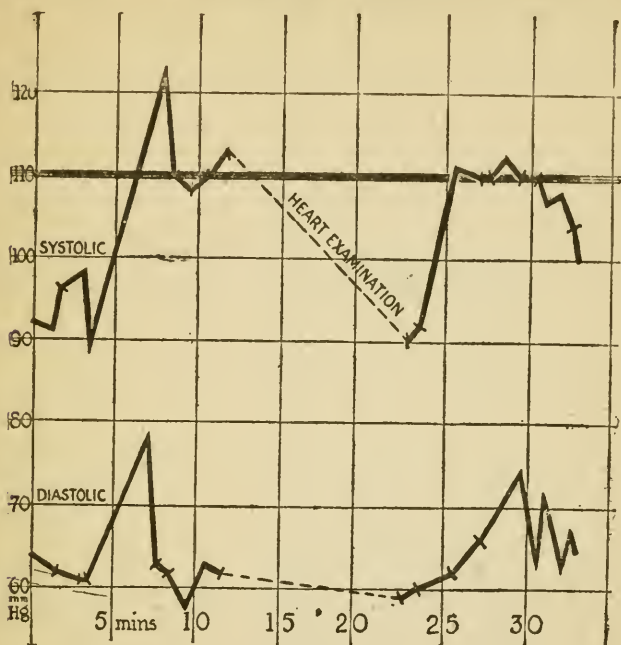


FIG. 5, A.

Hemobarogram B¹ 2. Woman, 19. The tenth minute shows a pleasure-anticipation fall beginning; this went on for five minutes, the systolic falling 28 millimeters, the diastolic falling quickly 4 millimeters then rising slightly in what is practically a plateau. This girl volunteered a report of long training in repression of the unpleasant for the sake of euphoria—happiness-training such as the “‘new’ thought” inculcates. In the 24th minute the memory of an unpleasant experience (involving some little difficulty) very quickly raised both the systolic and the diastolic and disturbed the vasomotor apparatus so much that all sounds forthwith disappeared for 6 minutes, and the diastolic sounds mostly for 15 minutes. The two heart-counts were 92.

essary that the slow nutritive processes, which have gradually furnished us our strength, are held in complete abeyance. The body is on a war foot-

ing, and every energy is bent to the quick mobilization of reserves. When nations are at war play grounds become places for drill, school houses are converted into hospitals, the lion's share of the food is withheld from the civil popu-

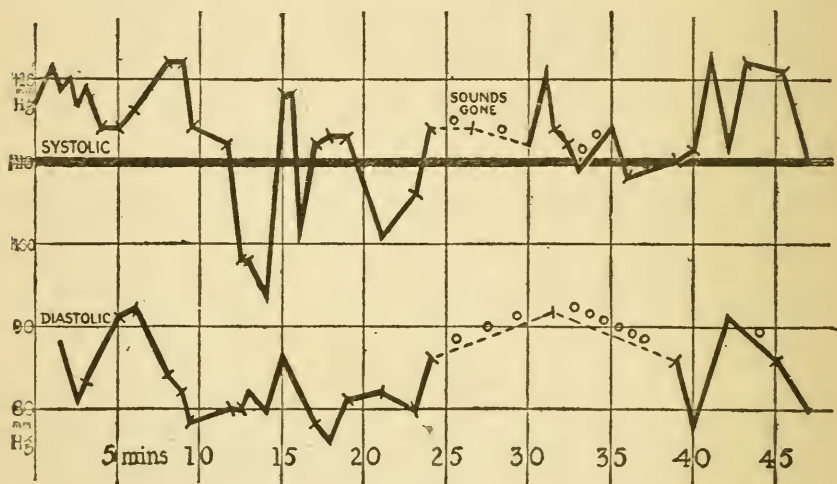


FIG. 5, B.

Hemobarogram B² 13. Woman, 22. The first half of this hemobarogram shows the marked rise in both pressures from the memory, most unpleasant, of a gastric ulcer a year before. The fall during a heart-examination is noteworthy. In the second half of the graph (24th minute) further anxiety over her aortic incompetency caused another rise. The heart-rate at first was 72 and at last 84.

lation to be rushed to the soldiers at the front, and the conservative industrial plants that bring material prosperity in peace, are converted into munition factories operating night and day. The nation is none the richer for all of this, but it is in a position to instantly consume its wealth in a

way favorable to its military intentions. Just so the body, when in extreme pain, foregoes instantly all the vegetative life which has slowly built it up, and gives itself to the task of drawing out all its latent power for use in one effort.

The chief recruiting officer of the body, to follow the military analogy further, has been discovered to be an insignificantly small gland, and one which until very recently was not thought to have any importance. The adrenal gland, located in the upper end of the kidney, has now been made famous by the work of Biedl, Dreyer, Elliott and especially Cannon. It is now known that adrenalin, the secretion of this gland, is produced by pain, bodily distress, or by any exciting emotion, including violent pleasures as well; and that it has a most remarkable variety of effects which help to render the blood instantly available and the muscular system ready for supreme effort. As soon as discharged into the blood it quickens the heart action, and causes a change in the constriction of the arteries of such a sort that all of the inner organs except the heart and lungs are deprived of their blood, whereas there is an enormous increase of blood supply to the limbs and

surface muscles. It brings it about that the liver releases extra stores of sugar, and thus gives extra food to the muscle cells which are thereby supplied for strenuous action. But most remarkable of all is the fact that it causes the blood to have a much quicker coagulation time than normal. This latter change is obviously of great advantage as a protection against mortal injury. The animal in great pain, and therefore secreting adrenalin, is actually better prepared for the healing of wounds, if it should receive them.

A further effect of having the circulation laden with adrenalin is that breathing is rendered easier. This is because the smooth muscle of the air tubes becomes relaxed so that the great inrush of air does not have to encounter contracted bronchioles. By this effect adrenalin brings it about that breathing does not become excessively labored even in supreme exertion.

Lastly, adrenalin gives to tired muscle the equivalent of rest. The injection of one cubic centimeter of adrenin has in fact been found to cause a recovery of from fifty to seventy-five per cent. efficiency in a fatigued muscle. This striking advantage enables the organism to continue the

struggle far beyond its ordinary powers, and it is hence not to be marveled at that a man frenzied with excitement seems to double or treble his strength.

This great number of advantageous reactions resulting from pain might have led us to the point of believing that pain was after all an excellent thing for the body. But let it be remembered that we are discussing the extra supplies drawn out in answer to excessive demands. When this mobilization proceeds moderately, as it does in response to active pleasure, the ultimate effect is tonic. But in pain the body is on an emergency basis and excessively so. The war debt will have to be paid when peace is declared. Then it will be discovered that the exchequer has been seriously depleted. When the object of tremendous struggle has been removed from the scene, we are left with depressed bodily states — slowed heart action, lowered blood pressure, and the inertia from digestive organs that have been violently put out of commission. It is this latter condition which is the real effect of pain. Unpleasantness evokes it directly without the temporary phase of excitement. It offers no definite deed to perform,

but leaves us to settle down at once to the depression which all things painful sooner or later bring about. The definiteness with which this depression of the body can be accomplished by means of depressive ideas has often been demonstrated experimentally. When a group of seventeen medical students were given milk-sugar pills, and informed that they had taken a new kind of cardiac depressant, thirteen of the number responded with a slower heart beat. Little wonder that the doctor should use such studious care to prevent anything resembling an atmosphere of gloom in his vicinity! The personal impression created by his presence is as potent a factor in producing substantial physical effects as are most of the medicines he is called on to administer.

Summary

In making any general statement in regard to the bodily effects of pain and pleasure it is necessary to keep continually in mind the difference between immediate and final effects of pain, and the difference in effect of the moderate and of the violent pleasures. Confining ourselves to the consideration of the immediate effects of pain and of

moderate pleasure we noted the following significant facts: Pain impedes digestion in every particular. It diminishes the secretion of saliva and of gastric juice, and delays the peristaltic contractions. Its immediate effect on the circulation is to give an extra supply of blood to the limbs, heart and lungs at the expense of the digestive organs. Further results of pain are that the liver releases an unusual supply of blood-sugar, the blood is more disposed to coagulation, the muscles are less fatigable, and rapid breathing is made easier through the relaxation of the air tubes. The immediate bodily effects of moderate pleasure are as a rule directly opposed to those of pain.

CHAPTER VI

THE NERVOUS BASIS OF PAIN AND PLEASURE

IT is an accepted doctrine of modern psychology that every possible variation in mental life corresponds to some variation in nervous condition. Psychology has been forced to accept this parallelism, partly because of the number of facts all pointing to the same conclusion, and partly because the theory offers the most intelligible basis for explaining mental life in terms of cause and effect.

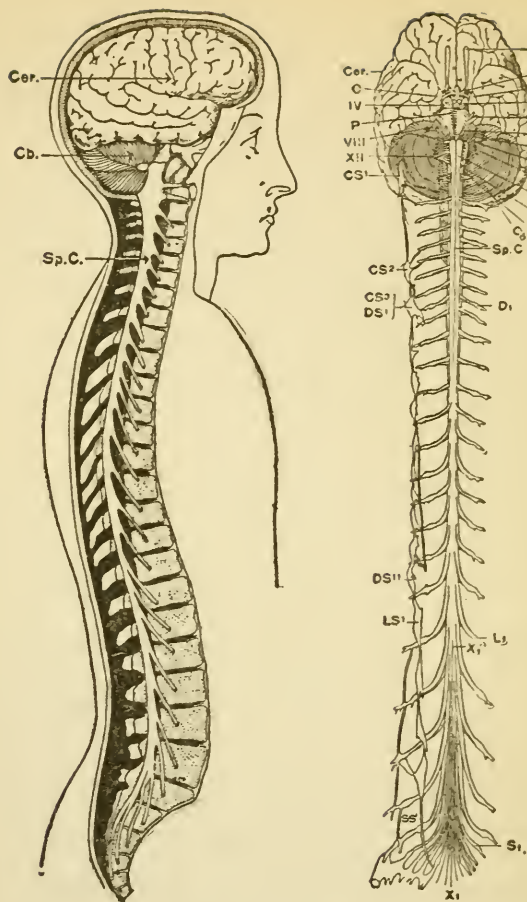
The main facts that point to an intimate relation between mind and brain are :

(1) The fact that any injury to the brain always means some loss of mental capacity. If the optic (second cranial) nerve is injured, the ability to see is either lost or impaired; likewise the invariable connection of hearing with the eighth nerve has been certainly established; and so on for all of the twelve cranial nerves.

(2) The fact that mental development always corresponds to brain development. The child's brain, like his mind, is much less developed than that of the man. Likewise the dog's brain falls far short of the man's in development; but for those mental abilities in which the dog surpasses man, as, for example, the sense of smell, there is a special brain part (the olfactory lobe), which is tremendously enlarged to correspond to his extra capacity.

(3) The fact that by stimulating certain parts of the brain it is possible to produce definite reactions. These reactions may be primarily motor, as when by applying a weak electric current to the Rolandic (upper central) part of a dog's brain, we succeed in producing now a movement of the front legs, now a wagging of the tail, now a barking. Again the effects may be sensory, as when we observe that in exploring the skin with a warm pointed cylinder, as often as the area touched corresponds to the location of a certain kind of nerve ending (corpuscle of Ruffini) under the skin, we are aware of the sensation of warmth.

Always and everywhere the story has been the same; more and more special nervous facts are



FIGS. 6 and 7.— Fig. 6 at the left shows the general relations of the central nervous system to the bones of the skull and spine. Figure 7, at the right, displays the general contours of the central system as seen from in front. The great ganglionated cord of the sympathetic system is shown attached to one side of the spinal nerves; the other side has been cut away. *Cer.*, the cerebral hemispheres; *O*, the olfactory centers; *M*, the medulla oblongata; *Cb.*, the cerebellum; *Sp.C.*, the spinal cord; *I*, the olfactory nerve; *II*, the optic nerve; *VIII*, the auditory nerve; *C*, the first cervical spinal nerve; *D₁*, the first dorsal, or thoracic, nerve; *L₁*, the first lumbar nerve; *S₁*, the first sacral nerve. (From Angell's Psychology, Courtesy Henry Holt & Co.)

being found to have an invariable connection with certain special mental facts. The advance of physiological psychology in this direction has been of a sort to justify ambitious hopes for the future. "No psychosis (mental activity) without neurosis (nervous activity)" has been the slogan, and the supposition has been that finding the particular neurosis for every particular psychosis is only a matter of time and more detailed progress.

It must be admitted, however, that pain and pleasure are not to be numbered among the conspicuous conquests of physiological psychology up to date. Indeed it may be said that it is even yet something of a moot point whether pain impulses ever reach the brain proper, or whether they stop just short of the cerebral hemispheres. The details regarding the distribution of pain nerves are likewise far from being satisfactorily made out, although much careful work has been done along this line.

The best evidence as to the brain-center for pain and pleasure, points to the so-called "optic thalamus" as being most directly concerned. If, for simplicity's sake, we picture the brain as formed of a top, middle and lower story, we may

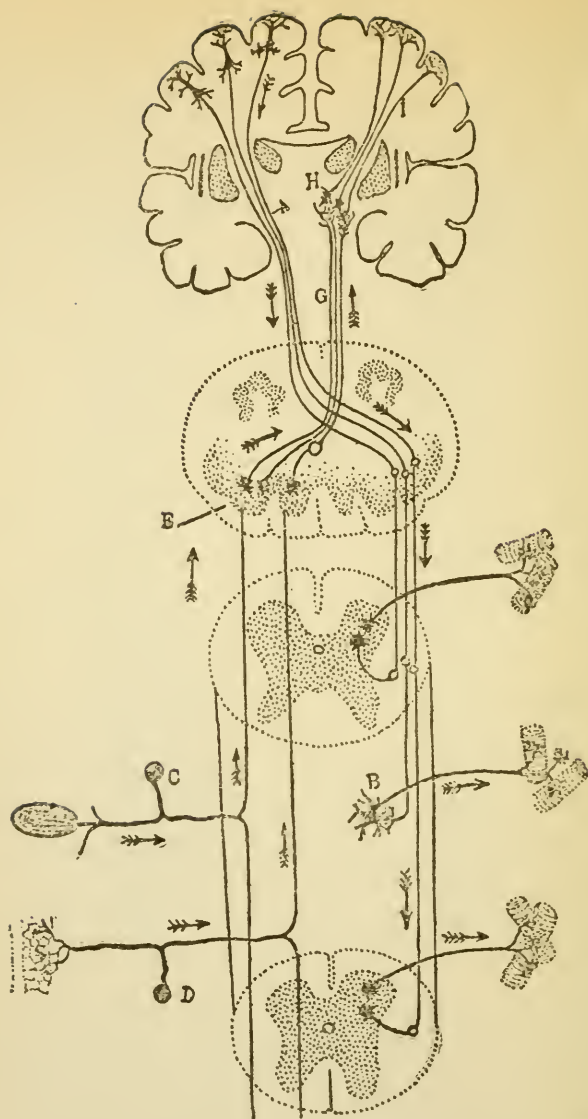


FIG. 8.— Showing schematically the ascending and descending tracts between cord and cortex. Impulses of pain transmitted from the skin to the spinal cord by way of C or D, ascend the sensory columns in the cord, and crossing over to G arrive at the thalamus, H. The cerebral hemispheres lie above. (From Pillsbury's "Fundamentals of Psychology," Courtesy the Macmillan Co.)

think of the thalamus as an important part of the middle story. Above it lie the cerebral hemispheres which, as is well known, subserve all of the special sensations but pain, and all of the imagery and association of ideas which go to make up our perception, memory, imagination and thought. In short, this upper story may be said to be the seat of sheer intellect and of deliberate control. But it is a feelingless part of the brain. Destruction to it is not marked by any change in the painful or pleasant aspects of things. The expression "cold intellectuality" seems appropriate to all of those phases of our mental life in which this upper brain level is primarily at work. If one finds a supreme virtue in knowing all things and suffering nothing, he must believe the need of the race is in more and more cerebral activity at the expense of activity of the lower brain centers.

Considerably below the thalamus lie the medulla and cerebellum, the lower story of the brain. Together with the spinal cord, these centers make it possible for us to perform those acts which are most necessary for our bodily existence. A frog deprived of all but these three centers is still able to breathe, swallow, swim, turn over from his

back, and make defensive movements in protection of his body when touched, but all of these activities seem to proceed automatically. Every object is, for him, only a space-occupying mass,

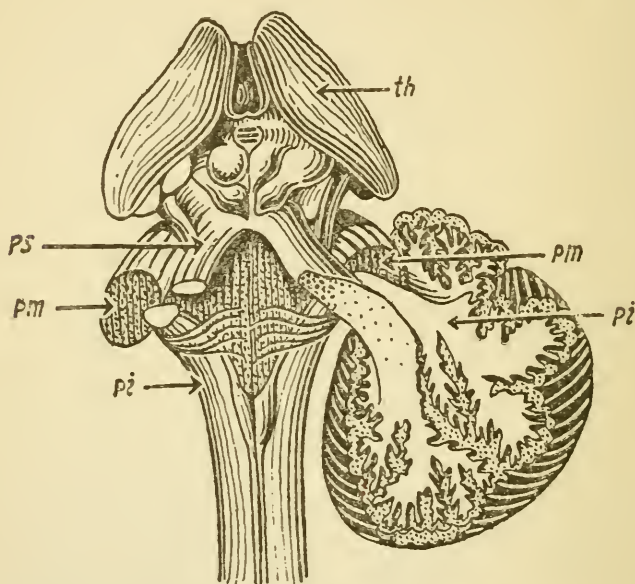


FIG. 9.— Showing the middle and lower brain. *th*, thalamus; *ps*, *pm*, *pi*, are superior, middle, and inferior peduncles of the cerebellum, which may itself be seen, in part cut away and drawn to one side. (After Wundt. From Pillsbury's "Fundamentals of Psychology," Courtesy the Macmillan Co.)

and not a something to call forth an attitude of like or dislike.

It is the middle story of the brain, containing the thalamus, which seems to furnish the special conditions of painful and pleasurable sensibility. When this part of the brain is injured, one of the

most conspicuous results is a great exaggeration of painful sensibility. After injury to the lateral zone of the thalamus, according to Herrick,¹ "acute, persistent, paroxysmal pains are always present, often intolerable and yielding to no analgesic treatment. There is also a tendency to react excessively to unpleasant stimuli." Even tickling becomes very unpleasant, but the pleasure from moderate warmth is increased. It appears then that when the thalamus through injury is somewhat isolated from the controlling activity of the cortex (top story), the result is a free play to its affective (feeling) activity. Both pleasure and pain become unrestrained and there is a consequent overloading of all sensations with an exaggerated feeling-tone. In these facts we find a neurological basis for the ancient distinction between mind and heart, for now it may be said that a man thinks with his cerebral hemispheres (top story), feels with his thalamus (middle story), and with his lower brain centers performs the machine-like acts which are regularly necessary to his very existence. It is evident that a well-rounded life, abounding in complex and

¹ Herrick, C. J., "Introduction to Neurology," 1916.

refined sentiments, rests on numerous inter-connections between the thalamus and the cortex. For it is the elaboration of connections in the cerebrum which gives crude feeling the basis for discrimination and thus lays the foundation for a critical appreciation of the things that please or displease. Culture and real artistic feeling are marked by the presence of this higher intellectuality in the things of the heart. But if the thalamus profits by its cortical connections, it renders value received in supplying the emotional drive without which mere intellectuality becomes arid and barren. [The pedant who, for all his learning, has no live interests, the prodigy of theory lacking utterly the glow of practical enthusiasms, the calculating schemer whose reptilian selfishness is unrelieved by any generous warmth, these are men whose cerebral organization (top story) has in a measure parted company with its thalamic foundation and naturally, when weighed in the balance by their fellows, they are found wanting.

The connections of pain and pleasure in the nervous system outside the brain, have not been at all clearly made out except for surface pain and

for tickling. Pleasantness and unpleasantness, it is generally agreed, are not to be referred to any particular nerves but depend on the kind of nervous discharge that is produced when any given nerves are called into activity. Pleasantness, for example, may result equally well from a stimulation of the nerves of taste or of smell, of hearing, or of vision. It is not the specific nerve but the character of the discharge that makes the difference between pleasantness and unpleasantness. A great variety of hypotheses have been advanced as to what it is about the nervous impulse that makes the difference. Perhaps the most widely discussed of these theories has been the one advanced by Marshall in his "Pleasure, Pain and *Æsthetics*," and recently restated in his later work entitled "Consciousness." Briefly stated, his view is that any nervous activity is pleasant, if it involves the use of surplus stored force; it is unpleasant whenever the energy demanded by the activity is greater than the amount which is readily available. In other words, pleasantness means that we are spending our surplus; unpleasantness, that we are drawing on our reserve. If a man

who has sat all day in a train enjoys getting out and walking briskly up the street, that is because the energy consumed in walking comes out of the abundance of the surplus which he has gradually stored up during his ride. If, after miles of such walking, he begins to find it unpleasant, the reason is that, having consumed his surplus, he begins after a time to find that the energy demanded by this activity is greater in amount than that which he can produce without drawing on his general reserve. The author of this theory has adduced many strong arguments in its support, but it has seemed to most psychologists that pleasure must rest on a more stable nervous condition than the mere burning up of a surplus — a process which it is hard to think of as drawn out in time, whereas any given pleasure may show a very considerable length of life. Moreover, the fact that pleasure is usually keenest where the issue of a conflict is most in the balance, is one which is difficult to interpret in terms of surplus energy consumption. The difference between just winning and just being defeated is as wide as the two poles, but the energy-depletion of the loser may not be conspicuously greater than that of the victor.

The more recent theory of Max Meyer ¹ is that "the correlate of pleasantness and unpleasantness is the increase or decrease of the intensity of a previously constant current, if the increase or decrease is caused by a force acting at a point other than the point of sensory stimulation." In other words, when a given nervous discharge is heightened by a sudden access of energy, we get pleasantness; when it is diminished by interference, we get unpleasantness.² "Imagine," says Professor Meyer, "you are interested in the presidential election. You have heard the dinner-bell and are rising from your chair. The cover of a magazine strikes your eyes, on which you read the title of an article on candidates for the presidency. This interferes with your walking to the dining-room and you experience a brief unpleasantness. . . . While you are reading the paper, every stimulation of your sense organs other than the sight of the printed pages is unable to reach its motor end, but must join and increase the intensity of the process of reading because of your acquired capacity for reacting strongly upon words and

¹ Max Meyer, "The Nervous Correlate of Pleasantness and Unpleasantness," *Psychological Review*, 1908, p. 307.

² Max Meyer, *op. cit.*, 317.

sentences which have the meaning of politics. According to our theory you experience pleasantness. Thus we see that an acquired capacity of attention can result in unpleasantness at the moment when attention begins and must result in pleasantness as long as attention in the same direction continues." Concentration of nervous energy appears in this theory as the physical basis of pleasantness, dissipation of energy corresponds to unpleasantness. It is the familiar contrast between easy working attention to what interests us, and the painful inability to collect our scattered thoughts when we find ourselves flying off at a tangent as one distraction succeeds another. Pleasure means nervous efficiency, not the efficiency of an overfed nerve-cell consuming its stored-up surplus, but that of a whole system of nerves converging on the accomplishment of an end. The detailed working out of this theory would lead us beyond the limits of the present discussion, but it is evident that it lends itself to a wide range of application. The last word that can be said at present is only conjecture. Only this much seems reasonably established — that the nervous basis of pleasantness and unpleasantness

is to be looked for rather in the general mode of functioning of the whole nervous system than in the specific properties of any special set of nerves.

Bodily distress and gratification appear to depend on the working of the special nervous system that supplies the abdominal cavity. [This system, the so-called autonomic, is made up principally of three great plexuses of nerve centers — the cranial, the solar, and the sacral plexus. It has long been known that a blow delivered at the solar plexus (in the pit of the stomach) would result in acute bodily distress, if not in actual collapse. This blow has always been a favorite resource of the prize-fighter, who, without making any pretence at a knowledge of the anatomical reasons connected with the "knock out," has nevertheless guided the delivery of his blow with the certainty born of much experience.

It is only quite recently that anything approaching a detailed knowledge of the autonomic nervous system has been worked out, and plausibility still has to take the place of proof when any general statement is offered as to its method of operation, but there is not a little evidence that points to the "sympathetic" nerves (those which connect the

region of the solar plexus with the spinal cord), as the conductors of inner bodily pains. It has been observed, for example, in cases of syringomyelia — a disease of the spinal cord — that when the injury to the cord occurs at a lower level than the entry of the “sympathetic” connections, bodily pains continue to be felt. But when the

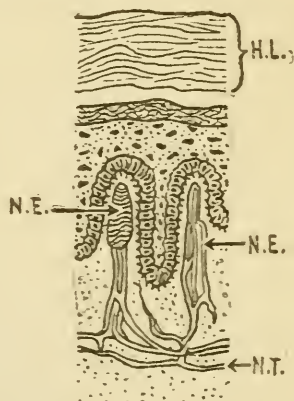


FIG. 10.—Cross section of skin. *hl.* horny layer of epidermis; *ne*, nerve endings; *nt*, nerve trunks, leading to spinal cord. (From Angell's "Psychology," Courtesy Henry Holt & Co.)

spinal injury occurs at a point higher than the fifth or sixth dorsal segment of the cord, that is, high enough to interfere with the central connections of the “sympathetic” nerves, no bodily pains are felt.

The nerve apparatus for surface pain and for tickling has been much more satisfactorily made out. Careful exploration of the skin with very

delicate hair points has afforded evidence of the existence of special pain spots which yield upon stimulation a pointed wiry sensation different from that of pressure or of temperature. These spots number from 100 to 200 per square centimeter, and their localization seems to correspond to that of the free nerve endings in the epidermis. Where the skin is lacking in this type of nerve ending it is insensitive to pain, as, for example, on the inside of the cheek, where the membranous covering can be bitten or pricked without causing more than the inconvenience of an abrasion. Where, on the other hand, this type of nerve is the only one to be found in a given area, the only sensation quality that can be obtained is that of pain. This is true of the cornea of the eye and of the tooth pulps. Contact with the "nerve" of a tooth is not felt as pressure, but only as pain.

[The pain nerves, although arranged in a separate system, are so intimately connected with the other nerves of the skin that any excessive stimulation of the senses of pressure or of temperature readily overflows into the pain channels, and the result is a painful quality, over and above that of the special sense in question. Thus very hot

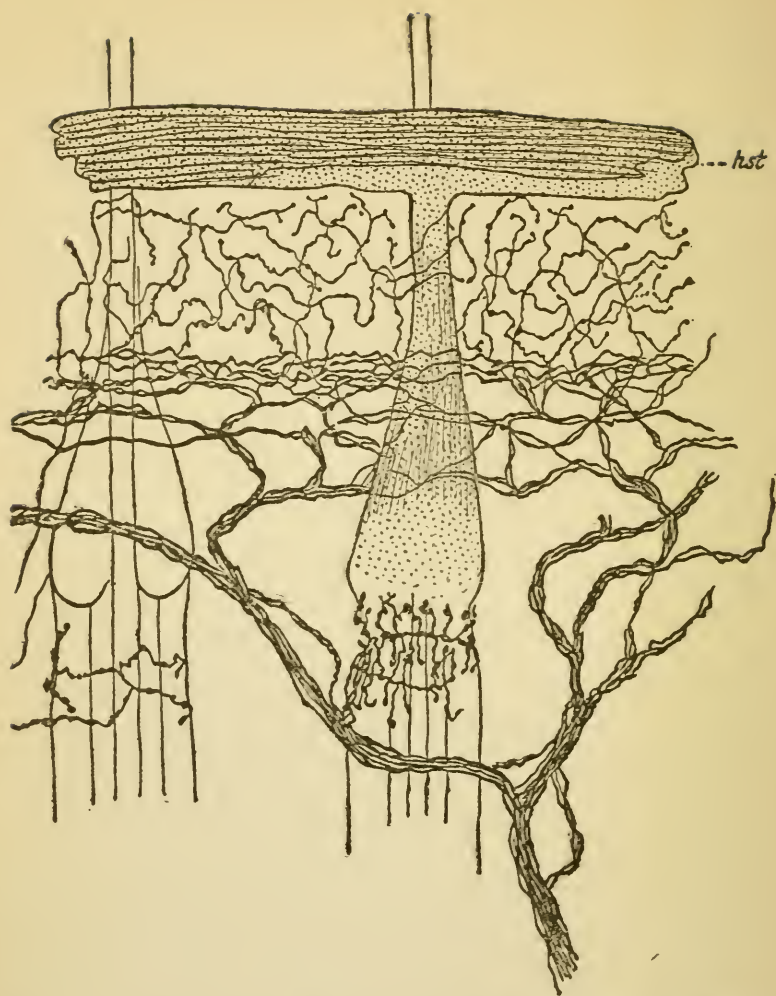


FIG. 11.—Nerve endings in skin and about hair follicles. The free nerve endings,—“pain spots” are just below the skin *hst*. (From Pillsbury's “Fundamentals of Psychology,” Courtesy the Macmillan Co.)

water feels both hot and painful; intense pressure feels both heavy and painful, and so on for practically all of the senses. It is as if pain had been only gradually differentiated from the other senses; in spite of its recently evolved special nervous machinery, it remains bound to the service of the older neurone systems, a sort of collateral pathway excited by excesses in the adjoining channels.

The pain fibers, on reaching the spinal cord, cross to the opposite side, and, ascending directly up the gray matter of the cord to the thalamus, they form the pain tract of the cord. "Injury to this path in the human body may cause complete insensitivity to both superficial and deep pain on the opposite side of the body below the site of injury, without loss of general tactile sensibility."¹ When the injury to this path has been only sufficient to dull and not destroy the functioning of the nerves, the result is that all pain becomes reduced to an itching. Experiments by Dr. Thöle, a German physiologist, show that when the spinal cord of a patient is anæsthetized, there is a cer-

¹ C. Judson Herrick, "Introduction to Neurology," Philadelphia, 1916, p. 251.

tain stage at which the patient will report that the pricking of a needle doesn't hurt, but itches. This is in accord with the fact that when the pain spots on the skin are very weakly stimulated, the result is an itching sensation which may be indifferent or even mildly pleasant, especially when scratching ensues. The sense of tickle shares the same nerves as the pressure sense. The end organs in the skin, which function for this sense, are therefore the bulbs at the roots of the hairs and, in the hairless regions of the skin, the corpuscles of Meissner. From these end organs, communication proceeds to the spinal cord and thence upward, by way of the special path for touch in the spinal lemniscus. It is possible for an injury to this path to take place in such fashion that a normal impulse of touch, such as pressure on the finger, merely tickles. It has been observed that when the spinal cord is anæsthetized, the gradual stages of deterioration in the functioning of the touch nerves is marked by first the loss of tickle, then of light touch, then of the sensation from solid contact. Tickling therefore appears as a partially effective pressure, which drops out when the nerve is considerably reduced in efficiency.

This accords with the fact that it is our sensitivity to extremely light touch that renders us ticklish under normal conditions.

In passing it may be noted that there is considerable evidence to the effect that the surface of the body has evolved more than one kind of system of nerve terminals. Head¹ has found evidence of as many as three separate systems, which he has called the systems of protopathic, epicritic, and deep sensibility, but inasmuch as the exact functioning of these separate systems is an obscure point, we must leave it with only passing mention.

Summary

We have seen that the most primitive kind of pleasure and pain is probably pleasantness and unpleasantness. Corresponding to this we have found that the nervous basis of pleasantness and unpleasantness is not a specially evolved system of nerves, but some characteristic of nervous impulses in general. The more special states of bodily distress and gratification seem to have a particular connection with the autonomic nervous system, which forms such a conspicuous feature of the

¹ Head, Rivers, and Sherren, op. cit.

inner body. Surface pain and tickling are seen to depend on the distribution of special nerves throughout the skin. These nerves group themselves into very definite paths in the spinal cord and communicate finally with the thalamus of the brain, which is the center at which all variations of our affective (feeling) life are brought to a focus.

CHAPTER VII

THE DIAGNOSTIC VALUE OF PAIN

"WHERE does it hurt you?" is generally the physician's first question. To be sure there are exceptional diseases in this respect, such as typhoid, scarlet fever, and malaria, in which local pain plays no part; there is also the well-known fact that just before death even the most painful diseases tend to become painless; but these few exceptions do not seriously affect the general statement that the pains reported by the patient are the physician's main reliance in all departments of diagnosis. And it is just for this reason that the physician's first care must be to satisfy himself as to the extent to which the patient's statement of the case can be accepted at face value. The thousands of over-tender sufferers, who daily pour out their exaggerated tale of woe, have done much to encourage a widespread belief in the unreality of all pain; and there is no gainsaying

the fact that a very considerable per cent. of reported pain is unreal in the sense that it probably has its basis not in serious organic lesion, but in morbidly directed attention to petty bodily disorders, which would pass unnoticed by a person of more robust nervous constitution. On this account the physician must in some measure diagnose the patient's mental tendencies before he can commit himself to a judgment regarding his physical condition.

The ease with which "imaginary" pain might be induced in a suggestible person can be readily seen in an illusion experiment which has been devised for a sense very closely related to pain, that of warmth. The subject is asked to hold in his hand a coil of German-silver wire, which seems to have some connection with four tungsten lamps, which give when lighted a powerful illumination, and he is told to expect the wire to become warm whenever he sees the lights turned on. Actually the wire will not become warm unless a secret switch underneath the box has been closed. The experimenter can operate this switch noiselessly without the subject's knowledge, and without in any way affecting the illumination of the lamps

which seem to be the real source of the heat. Many subjects, under these circumstances, will readily report that they feel the glow of warmth every time they see the powerful tungsten lights snapped on. Such subjects may be safely classified as over-suggestible, and their false report in regard to the experience of warmth, which demonstrably had no objective cause, leaves a strong presumption that if their report had referred to pain, for which the objective facts are difficult of access, the situation would be one to baffle an inexperienced diagnostician.

We have seen that the simplest general way to picture painfulness was as a struggle in which the organism puts up a losing fight. In the case ¹ of the "imaginary" pains the battle may be lost in one of two ways. It may be either through too much attention to the disturbance, or through too little resistance to it. In the former case we have the pains of psychasthenia, in the latter those of neurasthenia. [The psychasthenic will describe with a smile on his face the darting pains he felt a short time ago, when it seemed as if knife

¹ See C. L. Dana, "The Interpretation of Pain and the Dyesthesias," *Jour. Am. Med. Assoc.*, lvi, No. 11, 787.

blades were sticking in his knees. The memory of his pain brings with it no painfulness, because his original pain was due to a slight irritation which was morbidly enlarged by his attention. As soon as his attention is diverted, all trace of pain disappears. The neurasthenic is more likely to bring back his disorder as he describes it. His excessive weakness and irritability bring it about that a very slight reference to his headaches and backaches is sufficient to reinstate the moans that his tired heart and underfunctioning digestive system make only too easy for him.

Whenever a physician is called upon to deal with cases where there is reason to suspect the patient's ability to give a genuine account of his pains, he is likely to be guided by some two or three supplementary criteria which are useful in this connection. He watches the facial expression while testing the supposedly sensitive part. Usually the neuropathic patient, under such circumstances, fails in spite of his extreme statements, to show anything like the anxiety of expression that normal pain impresses on the faces of real sufferers. Another criterion is the fluctuation of blood pressure during a paroxysm of pain.

This index, however, is far less certain than that of the sympathetic reflex in the pupil of the eye. A clear dilatation of the pupil is convincing evidence that real pain is being felt. When a long past history of pain is complained of, it is useful to know also whether the loss of weight was considerable during that period, for the regular effect of long continued pain is a loss of bodily weight.

When it has been ascertained that the patient is to be regarded as trustworthy in his account of himself, the next great possibility of error lies in the fact that there are many pains of the sort known as referred pains. That is, the physical seat of trouble may be in one place and the pain be felt as located in a quite different part of the body. The pain may be transferred to the other side of the body, as when a patient with appendicitis sometimes feels nothing hurting him except on the left side. Much more frequent are the references up and down the body. For example, in one case of pain in the knee caused by a corn on the toe, the diagnosis was erroneously made and an operation was advised for loose cartilage in the knee.¹ But the fact that the patient felt

¹ See Rudolph Schmidt, "Pain," Philadelphia, 1911, p. 354ff.

the pains only when he wore boots or shoes finally gave the clue to their referred character. A still more curious instance is one in which pressure on a mole on the foot caused pain to be felt in the groin. Cases of downward reference are also of frequent occurrence, as when pain is felt in the leg as a result of tubercular disease in the spine, or when pain is felt in the little finger as a result of pressure on the ulnar nerve from a growth on the first rib.

In the head, the ear is a frequent repository of the troubles of other parts, as when an irritated lower tooth or tonsil causes a referred earache; and headache itself is the one form of pain which more than any other calls for taking account of the most remote bodily areas as disease centers. Thus there is the well-known headache from constipation or dyspepsia,¹ which disappears as soon as the stomach and intestine take up their normal functioning. In women the paths which lead to pain in the head are even more various than in men. Cases are recorded where habitual headaches disappeared after marriage or after the

¹ See R. J. Behan, "Pain: Its Origin, Conduction, Perception and Diagnostic Significance," New York, 1916.

birth of the first child, or as the result of some adjustment which had apparently not the remotest connection with the nerves of the head.

The greatest advance toward a systematic interpretation of referred pains was made through the researches of Head. He explained as follows the cases where internal organs affect definite areas of the skin. The diseased internal organ sends up its impulses to the appropriate segment in the spinal cord, and here the impulse, instead of keeping to its path, spreads itself diffusely into the near-lying fibers of the same segment. In so doing it may excite those fibers that supply areas of the skin from this particular spinal segment, and the result is that the skin sensation, being much more highly developed and accurately localized than visceral sensation, arrogates to itself the pain, and we feel as if hurt on the surface of the skin although injured inside the body.

To put the matter more simply, referred pain means that there has been a crossing of "wires" somewhere along the line, and in order to interpret it satisfactorily, it is necessary to know what are the possibilities of such crossing, i. e., what are the nervous impulses that come into near con-

tact in the same spinal segments or elsewhere. Head's work has done much toward clearing up this point. He has shown, for example, how a painful area in the temporal region of the head may be associated with impulses from the heart, lungs, or stomach; and how the area at the back of the head might be especially connected with the liver or intestine. Each organ within the head also has its maximum points of referred pain. For example, when the retina is involved, the crown of the head may be affected. But in spite of the exercise of the most careful study, we may well imagine that baffling cases of this sort will be constantly arising. One instance is recorded in which a woman, suffering apparently from the bronchial tubes, visited specialist after specialist, all to no purpose. One day by chance there was discovered in the outer ear a large plug of wax, and with its removal the coughing and irritation of the throat at once subsided.

The two great sources of error in the diagnosis of pain we have seen to be the imaginativeness of nervous patients, and the referred character of many pains in normal patients. Reasonable allowance being made for these two sources of

error, he bases his diagnosis of pain mainly on three criteria — location, time of occurrence, and influences that modify the pain. “Where does it hurt you?” “When does it hurt you?” “Under what conditions does it hurt you most and least?” These are the questions the answers to which make possible the intelligent interpretation of pains.

Location

Easiest to judge on this basis are the pains in the joints. The typical joint pain is clearly defined and without any radiation. There are a few exceptions, such as the radiations from the ankle joint in flat foot, but in general it can be said of the joints that the hurt will coincide pretty exactly with the trouble. On the other hand, there are pains which by their very characteristic radiations give the clue to diagnosis. Thus headaches that are due to too great intracranial pressure reach a maximum in the nape of the neck, and tend to radiate down the back, especially about the shoulder blades. When the seat of pain is inside the body, an important fact to ascertain is whether localization is confined to either the left or the right side. When both spontaneous

pain and tenderness to pressure occur on the left side below the arch formed by the lower ribs, ulcer of the stomach most naturally comes to mind, although affections of the spleen, intestine, and even heart are not barred from possibility. If the pain is limited to the right side, the probabilities first suggested are disease of the gall-bladder, of the duodenum, the colon, etc. The tenderness from a diseased appendix is generally quite low down.

Pains located in the shoulder are likewise of great suggestive value in sounding the condition of the inner organs. When a person of tuberculous appearance complains of shoulder pains, the physician at once has his attention directed to the pulmonary apices. When tuberculosis is out of the question, the next best guess is disease of the arteries, especially if the pain is increased by violent exertion, such as running up stairs. When the pain is of quite mild intensity, the probability is increased that the seat of inflammation is further down in the stomach, spleen, or liver, but in these cases there are usually other more pronounced local symptoms, so that the shoulder pain is only an incident in the diagnosis.

The above instances, taken somewhat at random from the vast amount of topographical detail that concerns the subject of pain, serve to indicate the delicacy of art that the physician must bring to his scientific knowledge in order to interpret his data rightly.

Time of Occurrence

Although the time of occurrence has a much more limited significance than the facts just discussed, it is of considerable importance to know what is the relation of a patient's pains to the hours of eating, and also to know whether the acutest attacks occur by day or by night. Thus pyloric colic has the regular characteristic that the afternoon attack begins two to three hours after the midday meal.¹ "At this time the expulsion of the gastric contents through the narrowed pylorus, or an attempt at this, takes place. Gastric rigidity sets in, and gurgling sounds are audible, while gas is belched up and there are eructations of sour fluid. Large quantities of indigestible food cause delay in the onset of the pain, but increase its severity. The attacks often

¹ Rudolph Schmidt, op. cit., p. 179.

last from two to three hours, and are ordinarily terminated by the onset of copious vomiting."

A much larger group of pains is characterized by onset at night. In the greatest per cent. of cases the pain of ulcer is nocturnal, the paroxysms occurring anywhere from eleven to one o'clock, and the pain lasting until the early morning. In general, colicky pains are most apt to be manifested during the midnight hours. Pains connected with the disease of syphilis have their onset regularly at night. The "nervous" headache of which the syphilitic in the secondary or tertiary stages complains is by far more common at night. Non-occurrence at that time almost justifies the rejection of syphilis as the cause. In addition, neuralgic pains, and most of the gastric seizures in general, are characteristically night pains. The fact of night onset for all of this group gives to the physician an additional means of determining the extent to which the patient is misled by his subjective feelings. The probability is that if the disturbance is sufficient to wake him out of his midnight sleep, the cause is a very substantial one. If, on the other hand, a neuralgia is complained of, which is severe by day, but never troublesome

at night, neuropathic condition of the patient is to that extent rendered more probable.

Modifying Factors

A peculiarity of all pain due to disorder in the circulatory apparatus is that any bodily motion tends to increase it. If a patient finds that the act of climbing stairs or of running for a car leaves him with a persistent pain in the back of the chest, it is the heart and arteries that we should naturally look to for the trouble. Motion of the body is a very useful index to abdominal disorders also, especially those in which the organs are congested, for in these cases any lifting, stooping, or bending back and forth is likely to increase pressure where there is already too much of it. "Pain in the neighborhood of the appendix," says Schmidt,¹ "is not rarely elicited in drawing on the shoes, lifting the head, bending the trunk, or sitting down, etc." Again,² "the jar communicated to the abdomen along the lower extremity on putting the foot to the ground may give rise to pain; for example, in the neighborhood of an inflamed appendix, a movable kidney." Naturally the dis-

¹ R. Schmidt, op. cit.

² R. Schmidt, op. cit.

orders of the organs of motion are most easily determined by direct motion of the parts themselves. Pain resulting from very slow motion of a joint gives a strong presumption in favor of arthralgia.

When motion proves to be of no especial consequence, it is often possible to be guided by the position of maximum pain. [Thus it has often been observed that when a patient with ulcer has a paroxysm of pain, the intensity can be varied greatly according as he lies on his face, back, or side. Patients with gastralgia are likely to find that lying on the right side increases their discomfort. It is almost as if they had forcibly moved the gastric contents across to that side. Colic pain is likewise made more acute by lying on the right side. Headache, when due to too great tension within the cranium, will be worst when the head is bent forward, and the greatest relief is to be had by bending the head backward as far as possible. This position seems to make for a diminution of the tension.

The one modifying factor that best serves to localize pains and to point to the seat of disorder is pressure. Here alone is a whole field for

diagnosis, and one which the physician with deft fingers makes peculiarly his own. The number of diagnoses that have been made possible by pulling and pushing the skin with occasional percussion, we can hardly hope to estimate, for tenderness to pressure is an almost constant feature of all local inflammation. The most conspicuous single instance perhaps is the pain caused by pressure in the region of the appendix during the stage of abscess formation. The very pressure of the bed clothes at this time may cause the most extreme agony. It is often of great diagnostic importance to know whether the pain can be relieved by the administration of local anæsthetics. If cocaine relieves the discomfort, the indication is clear that the pain producing factor is local, not general; hence a previous suspicion of something like gastric ulcer would be in a large measure justified, if local anæsthesia for that part of the abdomen temporarily relieved the situation.

The limits of our discussion have made it impossible to do more than barely outline the ways in which pain may be made serviceable in the interest of diagnosis, but enough has been said to make it clear that pain is by far the best instru-

ment of the diagnostician. Other accompanying symptoms such as swelling, peculiar formations, noises from within, etc., all have their usefulness, but they are in themselves generally very insufficient for an understanding of the nature of the disorder. The study of pain with especial emphasis on its location, time of occurrence, and conditions by which it can be increased or decreased — this is an indispensable support on which the physician must lean when taking counsel with himself as to how to proceed. When this fails him there is great probability of his being led astray. The writer knows a young man who, when a boy, had his appendix removed as the result of his falsified account of a pain in his side. He had stoutly maintained his statement before his parents and the doctor in order to free himself from the need of going back to school!

Summary

Pain is unquestionably the physician's most reliable dependence as a means of diagnosis, but it is necessary for him to have perpetually before him the possibility that a given pain may be "imaginary" (psychasthenic or neurasthenic), or

“referred” (giving a false indication as to the real source of the trouble). The former source of error he can in a measure guard against by tests of suggestibility, by noting the change of facial expression, of blood pressure and of the pupil reflex. It is only recently that anything like a systematic interpretation of referred pain has been begun.

The three most important criteria on which to base a diagnosis from pain were seen to be the location, the time of occurrence, and the possible modifying factors, such as motion, position and pressure.

CHAPTER VIII

ÆSTHETIC PLEASURE

WE have seen that the fundamental condition of pleasure is to be found in the struggle which we as living beings are constantly waging against the environment. Whether pleasure comes in the successful waging of the actual conflict or in the restful accumulation of strength preparatory to new struggle, it always derives its significance from this one great fact of life. Any situation which is adapted for the staging of a successful conflict is therefore eminently suited for affording us pleasure, and the æsthetic situation is one which is peculiarly effective for just this reason. Detached from reality though it may be, the artistic setting is one which calls into play a variety of tendencies which struggle for expression and find it. "Unity in variety" is the definition which has probably been most often applied to beauty, and by this definition beauty is at once seen to involve the mastery of complexities by a mind

which delights in combining, which refuses to allow things to be discrete, and determines wherever possible to assemble the various parts of the world into something intelligible. Every struggling mind which, like Archimedes, has triumphantly cried "Eureka!" on the discovery of a solution which simplified the bewildering complexities against which it was pitted, has known the thrill of unmixed pleasure.

"A theory is beautiful," says Stout,¹ "which brings under one point of view a multitude of facts previously dispersed without obvious bond of union; so that, instead of dissipating attention upon a loose aggregate, we can concentrate it upon a unified whole." The beauty and the pleasure in art are due to the fact that it supplies a multitude of detail that can be unified without undue strain. The more energetic and masterful the mind the more it will demand that the material of its art be really complex. Easy conquests afford it little satisfaction. A contrast between the art of the restless, self-assertive north European and that of the milder and more indolent south European bears out this point strikingly.

¹ Stout, *op. cit.*, p. 283.

Gehring in his suggestive book entitled "Racial Contrasts," has pointed out in some detail the remarkable difference between the art which satisfies the Italian and that which satisfies the Nordic mind. In the music of the former we find chiefly emphasized the simple melody sung by the voice and repeated only as an encore. In the music of northern Europe the dominating interest is not in the single melody but in involved counterpoint, in which several parts go their independent ways; it is not in the voice but in the orchestra; not in the aria but in the leitmotif which recurs in a variety of contexts, and helps to weave together the meaning of the whole opera. The comparison of the work of Rossini, Donizzetti, Verdi and Puccini with that of Bach, Beethoven, Wagner and Strauss certainly gives justification to sweeping statement. In literature the same distinction holds. Over against the simple charm of style which the Italian or French writer derives from the orderly arrangement of material which is not extremely involved, we have the elaborate, and even heavy, literary expression of the German and Englishman. The language itself is involved and lavish in figures of speech; but most marked is the

penchant for building up infinitely complex literary structures. Instead of the simple observance of the dramatic unities of time, place and action, we find Shakespeare introducing thirty-four characters in "Julius Cæsar," and keeping up three plots in "The Merchant of Venice"; we find Goethe employing two hundred individual speakers in "Faust," and leading the action through all ages and all parts of the universe. The English and German novels, too, attempt to bring together into a unity a large number of comparatively disconnected threads of interest, so that by the end of the book if the reader has succeeded in bringing his various interests through to a solution he has shown himself capable of no little synthesis. In painting, again, as in music and literature, the south European is satisfied with much simpler effect. In the Italian paintings graceful figures exquisitely colored are grouped symmetrically about a single center. In the Flemish and German paintings there is an extraordinary elaboration of detail and a large number of figures. The task for attention is at times huge. Even a single portrait is dealt with in such a way as to suggest an infinity of things not actually portrayed. The

Rembrandt portrait often seems as if about to speak, or at least it sets us to psychologizing as to what mental processes were represented on the canvas. The Böcklin or Turner landscape, instead of leaving us content with direct beauty, challenges us to penetrate deep mysteries. In architecture the Greek temple offers the same type of contrast with the Gothic cathedral. The perfection of simplicity of the Greek temple allows everything to be apprehended with little effort. The Gothic cathedral almost baffles us with its immense number of pillars and flying buttresses, statues, spires and windows.

Nordic art is a tribute to Nordic capacity for effort. It pitches the struggle at a level of intensity which would discourage a mind not well supplied with active tendencies. Not merely complexity, but even pain itself forms one of the fundamental conditions of æsthetic enjoyment for the north European. We find this explicitly recognized in much of their criticism of art and literature. For example, Schiller's dictum on tragedy was that "the highest degree of moral pleasure cannot make itself felt except in conflict. It follows hence that the highest degree of pleasure

must always be accompanied by pain." And, according to Marshall,¹ it was laid down by Schlegel as a principle of modern art that beauty and the characteristic ugly be indissolubly connected; and by Rosenkranz "that the artistic genius finds the triumph of his art where he represents the ugly objectified, and beauty all-powerful through triumph over evil." The same acknowledgment of difficulty and effort as indispensable to æsthetic pleasure is seen in Lessing's insistence that the artist's work be incomplete in detail in order to leave room for the imagination to work out its own salvation. Strict realism so exact in every detail as to forbid personal interpretation falls short of ideal beauty, because it leaves too little occasion for inner activity on the part of the spectator.

It is not by accident then that the artistic preëminence of any nation or people runs parallel with the power of that nation to achieve. The golden age in art has always been the golden age in national accomplishment. The age of Pericles in Greece, the Renaissance in Italy, the Eliza-

¹ H. R. Marshall, "Pain, Pleasure, and Æsthetics," London, p. 309.

bethan period in England, the Nineteenth Century in Germany, were all times in which great aspirations were being realized and the atmosphere was charged with the spirit of achievement. By the same token great art can hardly appear in a decadent age. "Where there is no vision the people perish," and one of the surest symptoms of approaching demise is the loss of artistic capacity.

But if difficulty is the handmaiden of æsthetic pleasure, it is clear that the degree of difficulty must accord with our power for solution. The arousal of activities which arrive nowhere can result only in an unpleasant jangling. "Beauty," said Schiller, "can tolerate nothing abrupt or violent"; and Spencer probably had a similar principle in mind when he made grace dependent on adaptation to ends. Complete æsthetic satisfaction comes about when manifold activities have reached their appropriate ends. This is very aptly illustrated in Marshall's ¹ comparison of the beauty of the suspension bridge with the ugliness of the cantilever. "All of nature's lines," he writes, "are affected by the power of gravitation. It seems clear to me that the relative grace of the

¹ Marshall, *op. cit.*

suspension bridge and of the cantilever is principally determined by the fact that the catenary curve in the one case presents to us nature's pendent form, while the strutted extensions of the cantilever bring to us other lines than those in accord with which she has educated us. As one's eye follows the lines of the truss, natural organic combinations bring preparation for action in certain directions. But the stimuli to these activities fail when the abrupt and rigid lines break off in directions which nature has never given us; the shocks . . . that result produce that sense of discomfort which we express by calling the work ugly."

[This same abortion of habitual activities is what displeases us when any striking disproportion of features renders a face hideously ugly, or when, in listening to music which we are prepared to follow through familiar progressions, we hear an incorrect note or a new variety of dissonance for which our musical education has left us ill adapted. The impossible sequences of chords which occur in the music of Schönberg have proven too much for the endurance of present day symphony audiences, and his eccentric progressions have been

greeted with an uproar of derisive laughter, even in restrained Boston. A more advanced age may become educated to the ability to unify this manifold of musical complexity, but for the present Schönberg offers only a warning example of the importance of knowing the limits of the hearer's power to combine sounds harmoniously.

In the enjoyment of rhythm also we are able to observe the importance of the adjustment of mental activity to the stimulus which it anticipates. As Stout observes, "where recurrence is regular, we are prepared for it. On the other hand, an irregularity which defies mental forecast, is perplexing and painful. When rhythm exists, the oncoming of a stimulus is met beforehand by a preëxcitement in conformity with it." But with special training it is quite possible to derive pleasure from rhythms so complex as to baffle us completely at the first encounter. It is a far cry from the simple time which the backwoods fiddler beats with his foot, to the involved rhythms and changes of tempo which add to the resources of an orchestral program. Rhythmic forms become amazingly complex in the dances of many savage tribes, notably among the American Indians,

whose war-dances are sometimes marked by variations altogether too subtle for detection by spectators unused to their rhythmic practices. As in the case of harmony, it is the mastery of complexities which affords the most intense pleasure, but any irregularity which exceeds our mental control is the occasion for violent unpleasantness or pain. The unhappiness of dancing with a partner continually out of step soon taxes one's ability to be even conventionally polite. Here is a situation which no preparation can match. Expectation is continually amiss, and every effort ends only in futility. It is little wonder that the average dancer much prefers as partner an insignificant person who dances well to one of great personal charm but with no sense of rhythm.

One important aspect of the connection of æsthetic pleasure with the fact of mental effort is to be discovered in the phase of rest after strenuous activity. The peculiar pleasure of listening to the resolution of a discord, or of sitting back easily for the quiet second movement of a symphony after fifteen minutes of storm and stress, are illustrations which at once come to mind. This phase of pleasure has so impressed some

thinkers that they have been inclined to make contrast an all-important factor in æsthetics. Fechner has gone so far as to make the statement that "pleasure experiences bring more pleasure the more they come in contrast with experiences of pain or less pleasure." [This would be true if the most significant part of activity were the rest afterwards, but we have not found this to be the case. The struggle itself we have been obliged to regard as the central fact. Recuperation is of importance chiefly as a preparation for action. Pleasures of inactivity are therefore in a sense incidental pleasures. They register the fulfillment of a temporary need, but are by no means the ultimate fact in the pleasure-pain situation. To assert that our greatest pleasures are those that follow pain is comparable to asserting that the climax of the day's work is the rest which comes when work is done.

Summary

In our brief review of æsthetics we have seen that the pleasure derived from this source is a special instance of the triumph of mental activity in overcoming a particular kind of difficulty.

Real art demands that we put forth a vigorous effort to comprehend a manifold of impressions in a single scheme of thought. When this effort is severe but successful, æsthetic joy is at its very pitch; when only a listless effort is called forth, the æsthetic work is trivial; when the effort demanded exceeds our powers of mental activity, or when there is violent thwarting of the powers called into play, we experience the painful shock of ugliness.

CHAPTER IX

PLEASURE IN PLAY

IT is one of the axioms of our everyday thinking that play is a form of pleasure. It is so universal in its power to bring delight that we take it as a matter of course that the human being of no matter what age or race, is enjoying himself when at play. The boy throwing himself with abandon into a game of ball; the adult eagerly seeking out his clubmates for an hour of billiards; the old man assiduously keeping up his golf — all testify to the fact that humanity has one of its most perpetual fountains of joy in the spirit of play.

This fact raises two questions of very great interest to one who would understand the ways of human nature: Why do we play? Why do we enjoy play?

[The first of these questions has been given a variety of answers. Spencer held that we play when we have an excess of energy and feel dis-

posed to let off steam. The frisky colt was for him the typical embodiment of the playful state of mind. But he took little account of the fact that play may go on to the point of exhaustion. A view which has been held especially by President G. Stanley Hall is that in play we hark back to the earlier existence of the species. In games of contest, for example, we are supposed to lapse into the past of ages long ago when personal encounters were of the tooth-and-nail variety, and the savage war of all against all made survival depend on an abundance of pugnacity. In an article written some years ago, this view is applied by Patrick to the psychology of American football. The author maintained that this game has developed such a gripping hold on players and spectators because of the many opportunities which it affords us to retreat through æons of time and live out some of the dormant tendencies to which the Twentieth Century civilized life affords little exercise. The same view is suggested with cynical jocoseness in the humorous setting of a recent popular magazine, in which two girls are represented as looking on at a football contest and discussing the effects of the game on

the players. In answer to her companion's query as to whether the game will brutalize the participants, the second girl replies, "Well, one must make men of them somehow."

Still another view of play which has found wide acceptance is that of the German psychologist, Karl Groos. He finds that play is most typically an activity of childhood, and believes that its real significance lies in the preparation which it affords for the serious activities that are to come with maturity. The small girl enjoying her dolls is becoming better fitted for the serious tasks of maternity. [The lad who enters into all of the activities of his gang is so much the better prepared to take up, when an adult, the work of social and political organization.

It is not necessary here to enter into the theoretical discussion of these views, each of which undoubtedly has in it a partial element of truth. The outstanding fact common to them all is that in play we give expression to certain definite inborn tendencies which demand more exercise than the mere routine of life affords them. These inborn tendencies, or instincts, are many in number, and of varying degrees of insistency.

Fear, anger, self-assertion, parental tenderness, sexual love, acquisitiveness and sociability are among the more powerful of the instinctive tendencies which drive us spontaneously to activities of the most vigorous character, when the circumstances are appropriate. Reason is thrown to the winds when a human being is thoroughly frightened or angered, when a parent is gravely concerned about his child, a lover about the object of his concern, a miser about his gold. The instincts at work are too impelling to admit of any hindrance or thwarting.

In play various instincts are in operation, but always in a peculiarly modified way; and this brings us to the answer to our second question. All instincts seem to afford pleasure in their playful manifestation, even those which are unpleasant at full intensity. The fear which is horrible becomes the thrill which is delightful. The anger which seeks utterly to destroy opposition becomes the social rivalry or the frolicking physical contest in which any serious injury to one's opponent is studiously avoided. If special illustrations were needed to make clear this difference, no more obvious example could be found than in the

behavior of dogs.¹ When two dogs fight, they are savagely intent on tearing and rending each other; when they play, they go through all of the outward form of combat, and yet the teeth which are pressed against the throat never inflict a wound. What is true of fear and anger obtains for all of the instincts when playfully manifested. The original instinct is reduced in intensity in such a fashion that it can be elaborated and prolonged without making any excessive demands on the organism. The sex instinct becomes connected with the elaborate joys of courtship and association; the gross impulse of hunger is refined to the more exquisite pleasure of the social meal partaken with many accessories and with the observance of polite custom; the instinct for acquisition becomes side-tracked into the mild enjoyment that is afforded by collecting the objects of one's hobbies; and serious curiosity is reduced to the idle interest in gossip and small talk. Even the instincts which are naturally connected with extremely disagreeable states of mind may undergo such special modification in play as to afford a certain thrill. The repulsion which normally causes us to shrink

¹ See W. McDougall, "Social Psychology."

with disgust may be mildly called forth with a not unfavorable effect. Games are not uncommon in which the chief attraction is touching with closed eyes horribly repulsive objects. Despite the creepy shudder with which the players of such games react to the unseen contacts, they continue to play as though fascinated by this very repulsiveness.

Summary

Without exception the peculiar pleasure of play seems to be connected with the fact that playful activity is a reduction and elaboration of grosser and more severe instinctive activity. The often excessive violence of fear, anger, repulsion, etc., is modified to the more controlled and always pleasant experiences of rivalry and adventure. The naturally agreeable emotions of parental tenderness, self-assertion, acquisition, etc., are replaced by the less pleasant but agreeably interesting make-believe states for which these instincts furnish the background.

CHAPTER X

THE PARADOX OF PLEASURE SEEKING

EVER since the memory of man there has always been a certain respectably large number of people who persuaded themselves that pleasure is something which ought to be sought. At times this hedonism, as it is called, has taken on a very gross and objectionable form, as when represented in phrases such as,

“Eat, drink, and be merry, for to-morrow we die.” At other times it has given itself a fairly respectable ethics by arguing that since virtue is identical with happiness the way to attain virtue is to seek happiness. But under some guise or other there has always been a widely current doctrine which made for the direct pursuit of pleasurable states of mind. One of the curious puzzles which has tried the wits of these people has been the paradoxical fact that the surest way to lose pleasure has been by directly seeking it.

Many a bachelor of independent means, after trying the luxury of first one fashionable resort and then another, has asked himself despondently why he seemed to derive so much less pleasure out of life than some hard-working clerk of his acquaintance, who must needs begin work at 8 o'clock sharp every day in the week, and whose slender financial resources permitted only very occasional and carefully planned vacations. He has had frequent reason to wonder why his immunity from work has brought him nothing but the melancholy of fatty degeneration, and he has unhappily shifted from one diversion to another only to find each turn to dust and ashes in his very pursuit of it. Worst of all he has found his capacity for pain and irritation enormously over-developed. His condition has become like that of the ancient sybarite who was uncomfortable even on his bed of rose leaves because one of them crumpled and hurt him! When such a person gives due reflection to his mental condition he is forced to conclude that even though pleasure be conceived of as the great end of life, it is certainly not an end which can be directly aimed at, and attained. It can only come as the by-product of aims of an

altogether different sort. It is something that can be added to his life as the result of correct living, but not something which can be achieved in its own right, then used as a guarantee that life is proceeding along the proper lines. The Epicureans put the cart before the horse; whatever the exaggerations of the Stoics, their method of procedure was psychologically sound. To make practical virtue the aim, to give one's self directly and with hardihood to the struggle for which he is by nature equipped, this is the only guarantee that insures our capacity for pleasure.

Who can imagine that any athletic team on the eve of a big contest would be willing to forego the excitement of the actual game by having themselves victors through forfeit? Not the desire for victory itself but the desire to win victory is the driving force back of their enthusiasm. The game is the thing in their mind, and their ambition to excel in competition would only be cruelly cheated if the need for competition were removed.

The fact that life is unthinkable except as a struggle, means, as we have seen in an earlier chapter, that access to pleasure is only to be had either through the activity of struggle itself, or in

a rest which prepares for further struggle. A life full of conflict must necessarily abound in both of these phases of pleasure, whereas a life from which the chief occasions for conflict have been removed must suffer a corresponding reduction in opportunity for pleasure, and the man thus deprived of rugged exercise soon comes to find even normal conflicts excessive and therefore painful. The practical question as to what type of life offers the most pleasure is one which admits of but one answer. It is the life in which conflict is deliberately chosen and efficiently prepared for. History offers an abundance of cases to prove that the above statement is true without exception. One is forced to think of stupendous workers like Charlemagne, Cromwell or Calvin as men far better acquainted with pleasure than their less energetic contemporaries. By contrast with these men one naturally turns to the decadent Roman emperors, men who, removed by their absolute world-dominion from even the responsibility of more worlds to conquer, gave themselves studiously to the joy of wielding the power which it required no effort of theirs to maintain. The historian Hodgkin, writing of Tiberius, Caligula,

Claudius and Nero, says that "standing as it were on the Mount of Temptation, and seeing all the kingdoms of the world and all the glory of them stretched at an immeasurable distance below their feet, they were seized with a dizziness of soul." We read that Tiberius in the later years of his reign built several villas on an island in the Bay of Naples, and having gathered about him a band of congenial companions, passed his time in scandalous profligacy. The penalty for softened moral fiber in all of these men seems to have been a jaded incapacity for normal enjoyment. One artificial extravagance after another was devised to whip up their dulled sensibilities. "Claudius determined to give an entertainment that should render insignificant all similar efforts. Upon a large lake, whose sloping banks afforded seats for the vast multitude of spectators, he exhibited a naval battle, in which two opposing fleets, bearing nineteen thousand gladiators, fought as though in real battle, till the water was reddened with blood and littered with the wreckage of the broken ships."¹ Nero's joy at the burning of Rome, which he himself is supposed to have instigated,

¹ Myers: "Rome: Its Rise and Fall," p. 343.

is another instance showing how sadly the mind is soon put to it when cut off from the normal conditions of life and left to create wantonly its own pleasurable situations. No normal person could help shuddering at the thought of entering into the state of mind of any of these emperors whose names have been so unfavorably impressed on the memory of the race. By comparison almost any extreme of asceticism would afford relief. And by contrast the lives of any of the world's famous men of iron, who have wrought serious purposes in spite of tremendous difficulty, seem to have been states of unmixed blessedness.

It appears then that even the frank pursuit of pleasure will fail of its ends unless the program followed gives expression to the sturdy and robust tendencies which every man possesses to a greater or less degree. The practical advice which James¹ offers, in his remarkably suggestive chapter on habit, may be quoted as entirely appropriate to the needs of any one interested in getting the most fundamental joys out of life. The passage reads, "Keep the faculty of effort alive in you by a little gratuitous exercise every

¹ James, *op. cit.*, p. 149.

day. That is, be systematically ascetic or heroic in little unnecessary points, do every day or two something for no other reason than that you would rather not do it. . . . The man who has daily inured himself to habits of concentrated attention, energetic volition, and self-denial in unnecessary things . . . will stand like a tower when everything rocks around him, and when his softer fellow-mortals are winnowed like chaff in the blast." ¹ But more than this, he will daily experience a greater quantity of pleasure than his softer fellow-mortals are capable of. Both in his activity and in his rest he comes nearer to the optimal conditions of his nature.

We have spoken so far of the general fact that man is a bundle of activity tendencies, and that his pleasure comes most naturally in the successful expression of these tendencies. It remains to point out how the existence of special aptitudes in different individuals forces expression along particular lines, if the talented person is to lead his life happily. Mozart's astounding ability to note from memory the Miserere of the Sistine Chapel

¹ James, "Psychology," p. 149.

forced him to seek music in order to find happiness. A world without music could by no possibility ever have been satisfying to his soul. Macaulay's prodigious visual memory, which enabled him to repeat literally page after page, must have forced him to find his real delight in a life of letters. The great captains of industry to-day are, as a rule, men in whom certain instinctive stirrings are constantly at work, impelling them to master the commercial environment which so readily inflames their imaginations. The inventor, even more than the money maker, is a man whose instinctive equipment drives him to find the same satisfaction in his contrivance that the beaver finds with his dam, or the bird with its nest. One of the chief reasons why the inventor is so impractical seems to be that he is so fascinated with the mere working out of the impulse to create that he is incapacitated for any methodical and systematic fashioning of his ideas. Bubbling over as he is with projects, his most intense pleasure is in the creation of the project rather than in its utilization. Almost every great inventor has spent much of his time and energy on

oddities, many of them with little possible use.¹ "Watt was interested in a quantity of inventions and devices. Among them may be mentioned a new kind of clock which, to quote Watt's own language, 'is to be ranked in mechanics as riddles and rebuses are ranked in poetry'; a micrometer; a drawing machine, which he himself termed 'a gimcrack'; a copying machine for letters, prototype of the copying devices so long in use; a machine for drying linen and muslin by steam." Watt's fertility for "gimcracks" seems to have been equaled by that of Ericsson. In a quotation from Church's "Life of Ericsson" cited by Taussig, we read the following: "When he [Ericsson] took possession of his new quarters [the house on Beach Street, which he bought in 1864] he found his company disputed by a numerous horde of rats, who considered themselves tenants at will, and stubbornly refused to yield possession. . . . Regarding the situation as a problem to be solved by mechanical means, with his own hands he drew the plans for a vast and mighty trap. To the leading idea [of a water-

¹ F. W. Taussig, "Inventors and Money-makers," New York, 1915, p. 27ff.

tank beneath a trap door] he laid no claim, but the details were wholly new, and upon an unheard-of scale. Tracings were made by an assistant draughtsman, and went the rounds of the shop; the pattern-maker, the brass-founder, the finisher, the carpenter, the tinsmith, each had a share in this novel work. At last it was completed and erected; it filled up half the basement, and was baited with half a cheese. . . . But he had underestimated the cunning of the rodents; as a place for keeping cheese in safety, the ponderous engine answered admirably, but it did not frighten away the obnoxious animals; and he was forced to admit that 'these little beasts have brains altogether too big for their heads.' "

From the foregoing examples it is clear that special aptitudes clamor for the opportunity of asserting themselves. The tasks which are their fit occasion of self-expression are the supreme joy of the man of genius, who will suffer every earthly privation rather than brook the thwarting of his talents. The conflict with the environment takes on a very special character in these men, but we see in their particular demands for self-realization merely a unique instance of the same principle

which applies to the rest of humanity. No mind ever appears on the scene of life in a state of emptiness, devoid of specific traits. All of us, no matter how mediocre, bring into the world a host of very definite tendencies, some of which we share in common with the whole race, others of which mark us for individualistic tastes, capacities and interests. The importance of these tendencies is that they compel us to give battle to the environment along certain definite lines, and incidentally afford us pleasure whenever the struggle is on. But far from urging us to pursue pleasure itself they direct us to the conquest of objects about us. They supply us with dominating interests, which in turn are our chief source of pleasure; but it would be a reversal of the psychological facts to say that pleasure is the normal incentive. It is the will to do, to attain, which lies immediately behind man's restless striving. Pleasure is not the condition of the struggle, but merely crowns strife when successful.

Summary

Pleasure is not obtainable by direct pursuit. It comes as the by-product of conflicts which engage

to the full the activity-tendencies that we bring with us into the world. The more the struggle is equal to our powers of conquest the greater will be the occasion of pleasure. This is particularly true of special talents which demand a special environment for their adequate exercise. The musician is happy when pitting himself against the world of sound; the captain of industry in seeking commerce finds pleasure; likewise the inventor, in order to arrive at pleasure must have free play to make mechanical conquests. Everywhere we find the same psychological law. Pleasure can not be consistently pursued of itself. It appears only as an incidental feature of self-expression.

CHAPTER XI

CONCLUSION

WE have seen that pain and pleasure sensations probably have their roots in an obscure state of feeling of like and dislike that is shared in some measure by the whole animal world, although it is doubtful at what point in the evolutionary series this feeling becomes sufficiently clear to be properly described by the term sensation. Whether as sensation or as feeling, the broad significance of pain and pleasure is to be found in the fact that life is essentially a struggle, in which pleasure is the accompaniment of some form of mental or physical success, and pain is an indication of defeat or of abortive effort. Different individuals enter the struggle variously equipped, and, according to their strength and particular kind of equipment, find it natural to pitch the contest at varying degrees of intensity and at points in the environment particularly vulnerable to their mode of attack.

Pleasure is not to be had by direct quest or by avoiding encounter, but only by making the venture and bringing it to a successful issue. Atrophy of original powers and a constantly increasing capacity for pain are the inevitable outcome of a purely defensive attitude toward life. To the man who would live happily there is but one course that is psychologically sound. Let him seek conflict and prepare to wage the struggle efficiently. In particular let him study to know his own individual aptitudes, and seek his clash with the environment at points where these can be brought strenuously into play.

BIBLIOGRAPHY

- ALECHSIEFF, N. Die Grundformen der Gefühle. Psycholog., Studien, 1907, 156-271.
- ALRUTZ, S. Die Kitzel und Juckempfindungen. Skand., Arch. f. Physiol., 1908, XX, 371.
- Ueber Schmerz und Schmerznerven, Eine kritische Historik. Arch. f. Physiol., 1905, 1-46.
- Untersuchungen ueber Schmerzpunkte und doppelte Schmerzempfindungen. Arch. f. Physiol., 1905, 414-430.
- ANGELL, J. R., and THOMPSON, H. B. A Study of the Relations between Certain Organic Processes and Consciousness. Psych. Rev., 1899, VI.
- BABLER, E. R. The Significance of Sudden Severe Abdominal Pain. New York Med. Jour., Aug. 5, 1905, 276-320.
- BALDWIN, J. M. Mental Development in the Child and the Race. 1906, 457 ff.
- BASLER, A. Experimentelle Untersuchungen ueber den Hautkitzel. Arch. f. d. ges. Physiol. (Pflueger), 1912, 375-392.
- BEHAN, R. J. Pain: Its Origin, Conduction, Perception and Diagnostic Significance. New York, 1916.
- BENN, A. W. Aristotle's Theory of Tragic Emotion. Mind, N. S., 1914, 84-90.
- BERNSTEIN, A. H. Reflex Pains. Internat. Jour. Surgery, New York, 1906, 252.
- BLOODGOOD, J. C. Abdominal Pain. Internat. Clin., 1907, 277.

- BORGQUIST, A. Crying. *Am. Jour. of Psychol.*, 1906, 149-206.
- BOS, C. Du plaisir de la douleur. *Rev. Phil.*, Paris, 1902, 60-74.
- BOWLBY, A. Pain: Its Importance in Diagnosis and Its Tendency to Mislead. *Clin. Jour.*, London, 1903, 289-296.
- CAIN, J. S. Pain as a Diagnostic Factor. *Nashville Jour. Med. and Surg.*, June, 1903, 243-250.
- CAMPBELL, J. A. E. Pain and Its Significance in Diagnosis. *Montreal Med. Jour.*, 1902, 471-478.
- CANNON, W. B. Bodily Changes in Pain, Hunger, Fear and Rage. New York, 1915.
- and WASHBURN, A. L. "An Explanation of Hunger. *Amer. Jour. of Physiol.*, 1912, 441-454.
- CORIAT, I. H. Pulse Reactions as a Measure of Emotion. *Jour. of Abnorm. Psychol.*, 1909, 261-279.
- CRILE, G. W. The Origin and Nature of the Emotions. 1915, Philadelphia.
- DALLEMAGNE, J. La Peine corporelle et ses Bases physiologiques. 1893.
- DANA, C. L. The Interpretation of Pain and the Dyesthesias. *Jour. Am. Med. Assoc.*, LVI, No. 11, 787.
- DEARBORN, G. V. N. The Emotion of Joy. *Mon. Sup. No. 9, Psychol. Rev.*, 1899.
- Certain Further Facts in the Physiology of Euphoria. *Psychol. Rev.*, 1914, 166-188.
- Some Practical Notes on Blood-Pressure. *Med. Rec.*, Sept., 1916.
- The Nature of the Smile and the Laugh. *Science*, 1900, 851-855.
- The Influence of Joy. Boston, 1916.
- DARWIN, C. The Expression of the Emotions. 1872.

- DEWEY, J. The Theory of Emotion. *Psych. Rev.*, 1895.
- DONOVAN, J. Why Do Animals Cry in Pain? *Lancet*, Jan., 1906.
- FERÉ, C. Travail et Plaisir. Paris, 1904.
- Douleur et Fatigue. *Compt. rend. soc. de biol.*, 1905, 12-15.
- FITE, W. The Place of Pleasure and Pain in Functional Psychology. *Psych. Rev.*, 1903, 633-644.
- FREY, M. VON. Beitr. zur Sinnesphysiol. d. Haut. *Ber. d. sächs. Gesell. d. Wiss.*, 1894, 1895, 1897.
- Vorlesungen ueber Physiologie. 1904, 308 ff.
- GARD, W. L. Some Neurological and Psychological Aspects of Shock. *Ped. Sem.*, 1909, 439-473.
- GASSER, H. The Physiology of Pain. *Med. Times*, 1903, XXXI.
- Pleasure and Pain Consciousness. *Tr. Med. Soc.*, Madison, Wisconsin, 1897, 562-577.
- GILMAN. Syllabus of Lectures on the Psychology of Pain and Pleasure. *Am. Jour. of Psychol.*, VI, I, 3-60.
- GOLDSCHIEDER, A. Gesammelte Abhandlungen. Leipzig, 1898.
- HALL, G. S., and ALLIN, A. The Psychology of Tickling and Laughter. *Am. Jour. of Psychol.*, 1898, 1-33.
- HEAD, H., RIVERS, W. H. R., and SHERREN, J. The Afferent Nervous System from a New Aspect. *Brain*, 1905, XXVIII, 99.
- HEAD, H., and RIVERS, W. H. R. A Human Experiment in Nerve Division. *Brain*, 1908, XXXI, 323.
- HEAD, H., and THOMPSON, T. On the Grouping of Afferent Impulses within the Spinal Cord. *Brain*, 1906, XXIX, 537-743.

- HERRICK, C. J. Introduction to Neurology. 1916, Chapter on Pleasure and Pain.
- HERTZ, A. F. The Sensibility of the Alimentary Canal in Health and Disease. *Lancet*, 1911.
- HOLMES, S. J. The Evolution of Animal Intelligence. New York, 1911.
- HOWELL, C. M. Pain: General Consideration. *Physiology*, 1909, 281.
- HUMPHRIES, F. H. What Is Pain? An Attempt to Define Its Origin and Nature. *Am. Phys.*, New York, 1908, 66-75.
- IOTEYKO, I., and STEFANOWSKA, M. *Psycho-physiologie de la douleur*. Paris, 1909.
- JAMES, W. Principles of Psychology. New York, 1894.
- KELCHNER, M. Die Abhängigkeit der Atem-und Pulsveränderung vom Reiz und vom Gefühl. *Arch. f. d. ges. Psychol.*, 1905.
- Sammelreferat ueber den gegenwärtigen Stand der Erörterung einiger Grundprobleme der Gefühlspsychologie. *Arch. f. d. ges. Psychol.*, 1910, 97-164.
- LAGERBORG, R. Das Gefühlsproblem. Leipzig, 1905.
- LANGE, C. Die Gemütsbewegungen. Würzburg, 1910.
- MANTEGAZZA, P. *Physiologie du Plaisir*. 1886.
- Physiologie de la Douleur*. 1888.
- MARSHALL, H. R. Pain, Pleasure and Esthetics. London, 1894.
- MEYER, M. The Nervous Correlate of Pleasantness and Unpleasantness. *Psych. Rev.*, 1908, two articles.
- MICHAELIS, A. Der Schmerz. Leipzig, 1905.
- MUENSTERBERG, H. Lust and Unlust. Beiträge zur experimentellen Psychologie, No. 4.
- MURRAY, E. A Qualitative Analysis of Tickling. *Am. Jour. Psych.*, 1908, 289.

- NICHOLS, H. Origin of Pleasure and Pain. *Philos. Rev.*, 1892, Nos. 4 and 5.
- PFORDTEN, O. VON DER. Empfindung und Gefühl. *Zeitsch. f. Psychol.*, 1912, 61-95.
- REHWOLDT, F. Ueber respiratorische Affektsymptome. *Psych. Studien*, 1911, 141-195.
- RIBOT, TH. Problèmes de psychologie affective. Paris, 1910.
- Pathological Pleasures and Pains. *Monist*, 1895, 176 ff.
- ROUX, J. La Sensation douloureuse. 1896.
- SCHMIDT, R. Pain: Its Diagnostic Significance. Amer. trans., Philadelphia, 1908.
- SHEPARD, J. F. Organic Changes and Feeling. *Amer. Jour. of Psych.*, 1906, 522-584.
- SHERRINGTON, C. S. Cutaneous Sensations, in Schaefer's *Text-book of Physiology*. London, 1900.
- The Integrative Action of the Nervous System. New York, 1906.
- STERNBERG, W. Kitzel und Juckempfindung. *Zsch. f. Sinnesphysiol.*, 1910, 51-56.
- Die Kitzelgefühle. *Zentralbl. f. Physiol.*, 1910, 865.
- Die Physiologie der Kitzelgefühle. *Zsch. f. Psychol.*, 1911, 73-109.
- STÖRRING, G. Experimentelle Beiträge zur Lehre vom Gefühle. *Archiv. f. d. ges. Psychol.*, 1905, 316-356.
- STOUT, G. F. *Analytic Psychology*. London, 1896, Chapter on Pleasure and Pain.
- STUMPF, C. Ueber Gefühlsempfindungen. *Zsch. f. Psychol.*, 1906, I.
- STRONG, C. D. Physical Pain and Pain Nerves. *Psych. Rev.*, 1896, 64 ff.

- STRONG, C. D. The Psychology of Pain. Psych. Rev., 1895, II, 329-377.
- SULLY, J. Essay on Laughter. London, 1907.
- SWIFT, E. J. Sensibility to Pain. Amer. Jour. Physiol., 1900, XI, 312-317.
- THÖLE. Ueber Jucken und Kitzeln in Beziehung zu Schmerzgefühl und Tastempfindung. Neurol. Centblatt, 1912, 610-617.
- TITCHENER, E. B. Lectures on the Elementary Psychology of Feeling and Attention. New York, 1908.
- THUNBERG, T. Physiologie d. Druck, Temperatur und Schmerzempfindungen, in Nagel's Handbuch der Physiologie. 1905, III, 647.
- TÖRÖK, L. Ueber das Wesen der Juckempfindung. Zsch. f. Psychol., 1907, 23 ff.
- UPHAM, H. L. Pleasure and Pain. Boston, 1891.
- WASHBURN, M. F. The Animal Mind. New York, 1913.
- WELD, H. P. An Experimental Study of Musical Enjoyment. Am. Jour. of Psych., 1912, 245-308.
- WITMER, L. Pain. Twentieth Century Practice, 1897, 903-945.
- WUNDT, W. Outlines of Psychology. 1907.

INDEX

- Adrenalin, 91-93
- Æsthetics, 63-64, 134-145
- Amœba, 35-38
- Anger, 17, 149-150
- Blood pressure, 89-90, 120
- Bodily distress, *see* Distress
- Cerebellum, 101-102
- Cerebrum, 46, 100-101
- Circulation, 8, 89-94
- Coagulation, 92
- Diagnostic value of pain, 117-133
- Digestion, 80-88
- Discord, 143
- Distress, Bodily, 4, 42-44, 70-73
 - quality of, 7
 - reaction to, 8
- Earthworm, 34, 42-44
- Epicureans, 154
- Epidermis, 110
- Fear, as cause of pleasure, 56, 149-150
- Feeling, 10
- Freud, 28
- Gratification, 22-28, 70-73
- Hunger, 7, 71
- Imaginary pain, 118-119
- Instincts, 148-149
- Inventors, 159-161
- Itch, 58
- Jellyfish, 40-41
- Laughter, 55, 66
- Marshall's theory, 105-106
- Medulla, 101-102
- Memory, of pain, 57, 66
 - of pleasure, 57, 66
- Meyer's theory, 107-108
- Music, 63-64, 136
 - see also* Æsthetics
- Nervous system, central, 98
 - sympathetic, 44, 109-110
- Neurasthenia, 88, 119-120
- Nordic art, 136-139
- Olfactory lobe, 99
- Optic nerve, 96
- Optic thalamus, *see* Thalamus
- Pain spots, 111-112
- Pain, Biological basis of, 58-59
 - bodily effects of, 76-95
 - conflict theory, 58-62
 - development of, 32-52
 - diagnostic value of, 117-133
 - duration, 3
 - imaginary, 118-119

- Marshall's theory, 105-106
 Meyer's theory, 107-108
 nervous basis of, 96-116
 relation to pleasure, 53-75
 varieties of, *see* Surface
 pain, Distress, Unpleasant-
 ness
 Paramœcium, 88-89
 Peristalsis, 84-86
 Play, 146-151
 Pleasantness, 28-31, 35-39
 Quality, 29, Stimuli, 30, Re-
 action to, 30-31
 Pleasure, 16
 biological basis of, 58-59
 bodily effects, 76-95
 conflict theory, 58-62
 development, 32-52
 Marshall's theory, 105-106
 Meyer's theory, 107-108
 nervous basis of, 96-116
 relation to pain, 53-75
 varieties of, 31-32
 see also Tickling, Gratifi-
 cation, Pleasantness
 Pleasure-seeking, 152-163
 Psychasthenia, 119-120
 Psycho-physical parallelism,
 96-99
 Referred pain, 121-123
 Rhythm, 142-143
 Ruffini, corpuscles of, 97
 Salivary secretion, 82
 Satiety, 23
 Sex impulse, 27-28, 40, 150
 Spinal cord, 113-114
 Starfish, 41
 Stoics, 154
 Stomach, 5, 71, 82-86
 Surface pain, 46-47, 73-74
 Quality of, 2
 Reaction to, 3
 Sympathetic nervous system,
 44, 109
 Thalamus, 99-104
 Thirst, 24, 25
 Tickling, 16-22, 47-50, 73-74
 Stimuli, 16-17
 Vulnerability, 19
 Quality, 20
 Reaction to, 21
 Unpleasantness, 9, 35-39
 quality, 9
 reaction to, 12

COLUMBIA UNIVERSITY LIBRARIES

This book is due on the date indicated below, or at the expiration of a definite period after the date of borrowing, as provided by the library rules or by special arrangement with the Librarian in charge.

DATE BORROWED	DATE DUE	DATE BORROWED	DATE DUE
FEB 18 1966			
C28 (764) 50M			

QPA35

Annex Out 3.

1917

Moore

Pain and Pleasure

in the ...

Aug 24

Annex

